CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 OCTOBER 1948 SIDNEY D. KIRKPATRICK, Editor

Another Milestone

As a profession we have reason to be proud of the progress made in the past 15 years. It was in 1933, just as we were emerging from the depression, that this magazine first announced an award for chemical engineering achievement. Its original purpose was to stimulate group effort by publicly recognizing the accomplishments of those progressive companies in which chemical engineers had been encouraged to participate in all phases of the industry. We have traveled far since then, but there are still many frontiers ahead.

One of the most promising of these is the petrochemical industry which is recognized in this year's award to the Shell Development Co. The Committee's decision rested not alone on chemical engineering achievements in the commercial synthesis of glycerine, but also on the underlying character and policies of the Shell organization. Those of you who plan to be in New York for the annual meeting of the American Institute of Chemical Engineers are cordially invited to join with us at the Award Dinner in the Waldorf on November 10.

What Price Construction?

Several leading chemical firms have found it advantageous to postpone the building of new or enlarged facilities because of present high construction costs. Perhaps most prominent in this list of deferments has been the Stanolind decision to postpone the building in Kansas of the large synthetic fuel and chemical plant which has received such wide publicity.

Many will regret that this decision was necessary. Many of us had hoped that Stanolind's brave project would bring us some outstanding commercial-scale results in this important field. It was generally believed that these results, as well as those expected from Brownsville, Texas, where Carthage Hydrocol now has its facilities well along in construction, might help us determine the economic as well as the technical feasibility of synthetic fuels from natural gas.

Many firms in the process industries are faced with problems of this sort. It is sincerely to be hoped that rising costs will not force the postponement of projects having such an important bearing on the long-time prospects of research and development. Delay in expansion programs for proved facilities is much less serious. They can come later when the need is sufficiently pressing to offset the higher building cost. But there is no offset for the misfortune of not having facts needed to establish the basis of new processes and new industries.

Top executives in the chemical process industries should ponder seriously any postponement or cancellation of this type of undertaking, despite the heavier initial investment. The results of such first-plant building have capital values of tremendous importance to the country as well as to the individual enterprise.

Educational Orphans

In Madison last month we listened to a paper that had some of our most distinguished educators squirming nervously in their chairs. It was a discussion of teacher qualifications in relation to education outside the classroom. Words of great wisdom came from the mouth of a graduate student, William E. Ranz, Procter & Gamble fellow at the University of Cincinnati. When he finished his paper a dozen professors were on their feet to protest —yet there were many more who recognized and applauded the validity of the young man's indictment.

Ranz began by citing the plight of the mass-produced graduate of the large university who objected most to the completely impersonal way in which technical knowledge had been shoved down his throat. His formal training for living consisted of nothing more than classroom facts and figures. The great responsibility for his mental, moral and social development had been relegated haphazardly to chance associates in his rooming house or at the corner drug store.

In these days when science and technology are recognized as social, economic and political forces, classroom education is not enough. To be sure, most schools have altered their curricula to include more of the so-called humanities, but these often fail in their purpose because there is no one interested in fitting them into the lives and hopes of the students.

With almost unfailing instinct, the student recognizes the good teacher. He may not be the most distinguished or most brilliant member of the staff. But he takes his work seriously, is genuinely and enthusiastically interested in the education of his students—not as a cold, impersonal process, but in the warm human sense of guiding the individual student in his mental and social development.

As Mr. Ranz observed, the average university provides for a maximum of only about 25 hours per week of direct supervision by the teachers who are charged with the student's training. In the other five-sixths of the week the student is on his own, and what he gets or fails to get

in the way of worthwhile education is often determined entirely outside of the classroom.

Should the teacher share in that responsibility? We think he should, and, with the young man from Cincinnati, we, too, wonder "whether or not the teacher's interest in, and influence on, all phases of the student's education outside, as well as inside, the classroom is not directly proportional to his qualifications and success as a teacher."

Still More Are Needed

RECENTLY the Bureau of Mines made a review of existing facilities for coke manufacture in the United States. It surveyed the existing oven capacity and summarized its findings in some rather startling conclusions.

A tremendous increase in coke-oven capacity has been put into operation during the five years, 1944 through 1948, including a number of batteries which will not push coke until the end of this year. This recent construction represents one of the greatest upsurges in new oven building in the history of the industry. But that is not the whole story.

Fully half of the new capacity built during the five-year period just ending represents mere replacement of old capacity that could no longer be operated safely. Even including this large new capacity, more than a third of all present byproduct ovens are over 25 years old. Weighted by tonnage, the average age of all existing ovens at the end of 1948 will be approximately 20 years.

There are several reasons why this is serious and why chemical enterprise should be concerned about it. We cannot get enough steel if there is not enough coke. Coal chemicals will not be made in adequate quantity if there is not more oven capacity erected in the early future. Conceivably the blast furnaces of the country might tremendously increase the use of beehive coke during a period of emergency. That would increase steel output but would no nothing to increase tar, benzol, toluol, or other coal-chemicals.

Fortunately, there are some alternatives, and these are being explored and developed. The petroleum refineries can make the major light oils and can recover them with profit at a price. This was proved by the huge toluol production of the late war period. We know from that experience about what toluol costs from that source. We do not yet have comparable knowledge for benzol but it is fast being accumulated. What we know about petroleum sources of naphthalene and the tar acids is equally inadequate.

Chemical industries, which are vitally concerned with all these problems, should explore them further in cooperation with the steel industry and the builders of coke ovens. Meanwhile we can count on the petrochemical engineers to continue their research and development programs. Altogether it is a big job. But it needs doing.

For Want of a Nail

SELDOM does a large process industry find that its business depends solely on a single method of chemical analysis. Just now that appears to be the case in the field of superphosphate and the supply of phosphate rock from the United States to Europe. Also involved are certain basic principles of both technology and public policy.

Fertilizer is vital for European relief and rehabilitation. As in the United States, the most important single item will be superphosphate. But in Europe they have a different method for evaluating this component. Therein lies the present uncertainty.

The Economic Cooperation Administration wants Europe to use North African phosphate for the manufacture of its needed superphosphate. They do not want American dollars spent for American phosphate rock unnecessarily. But when European makers of superphosphate use only North African rock for acidulation, the characteristic European test indicates a low-grade fertilizer. That test credits the chemical manufacturer with only the water-soluble phosphate. The same product tested in the United States by the citrate-soluble method would rate high enough to meet our accepted standards which are based on long studies by agronomists who have proved that all of the citrate-soluble phosphate is actually available as a plant food. Hence ECA asks the Marshall Plan countries to change the basis of their test, use North African rock, and save dollars to buy other things than American phosphate rock.

We anticipate that some intermediate point will be found for final action. We hope that this decision can be reached on a basis that will put American dollars to the maximum usefulness in the program. If this involves a change in the system of rating fertilizers in Europe, we believe that this is a modification that should be made for the over-all benefit of American taxpayers and European nations. Incidentally, there is now enough phosphate rock so that no scarcity for American agriculture will develop even if the maximum shipment to Europe should continue.

Depression Prevention

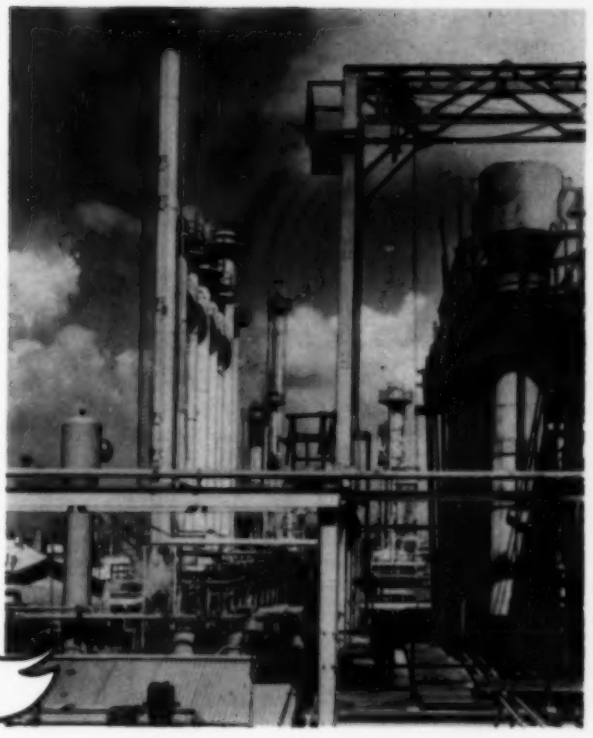
"CAN businessmen do something to sustain prosperity? Can they assist in the prevention of depression? Can they contribute toward solution of the 'boom-bust' problem?" We quote this not from some political demagogue or yellow journalist but from a publication of the Chamber of Commerce of the United States. We are encouraged to see a conservative agency come out with a frank facing of these facts of economic life.

To support its stand for sincere effort and affirmative answers to these questions, the National Chamber has issued a little booklet which it calls "Business Management Action Against Depression." Both executives and engineers of the process industries will do well to review the do's and dont's simply presented in that short publication.

We warn our readers that this booklet is not going to tell you anything new or startling. But it does present in a simple straightforward way many of the basic principles which we all vaguely know, but too often forget. Management in the process industries, representing roughly 20 percent of all manufacturing in the United States, can well review the elements of anti-depression philosophy. Our collective influence will be significant and good for the public generally.

The less pessimistic we feel right now, the more we need to review this situation.

For Progress in Petroleum Chemicals



AMERICA'S MOST CHALLENGING RESOURCE is petroleum. Other nations have based their chemical industries on coal, salt or wood. Even we in the United States have been relatively slow in recognizing the superior potentialities of petroleum as a chemical raw material. But within the past two decades we have begun the development of a petrochemical industry that seems destined ultimately to dominate our chemical economy.

That this industrial advance should parallel the rapid growth and development of the American chemical engineering profession is more than mere coincidence. Petrochemicals, in the volume and variety we know them today, could not have been produced without the modern processes and equipment of the chemical engineer. His technology has translated the results of research into efficient plants for large-scale production.

Most appropriately, therefore, the 1948 Award for Chemical Engineering Achievement recognizes the important contributions of a great pioneering organization in the petrochemical industry. The Committee of Award, comprised of more than fifty senior educators under the chairmanship of Professor-Emeritus Alfred H. White, has voted that this year's award should go to the Shell Development Company, research and development affiliate of Shell Oil Company and Shell Chemical Corporation. The specific citation is for Shell's postwar achievements in the successful synthesis of glycerine from petroleum for the first time on a commercial scale. But the award also recognizes a long-time program of pioneer-

ing in petrochemicals and other outstanding applications of chemical engineering in the petroleum industry.

Shell's current achievements stem from fundamental research begun even before 1930. Thus there has been built a foundation for the future in the form of basic information on the science of petroleum and its chemical derivatives. New processes and products were developed for the petroleum industry, and simultaneously their outstanding program of manufacturing chemicals from petroleum hydrocarbons forged ahead. Process development, pilot-plant operations and engineering design became increasingly important and active functions. With a continuously supplied storehouse of basic data, the application of experimental methods and engineering skills has brought forth a flowing stream of new commercial projects that in turn have given rise to new industries.

Chemical engineers perform essential functions at practically every stage in this continuing program. On their shoulders rests the responsibility of devising plants that operate safely, efficiently and profitably—the culmination of research effort. Accordingly, Shell management has encouraged and trained its chemical engineers to participate broadly in all of the manifold affairs of its industry.

To reward achievements of corporate groups such as the Shell Development Company, this unique award was established in 1933. Unlike most medals and similar citations, it is presented to a company rather than an individual, for its prime purpose is to recognize the accomplishments resulting from the coordinated endeavors of an entire organization--of its executive, research, engineering, production and sales staffs.

Thus Shell Development Company takes its place on the honor roll of progressive companies that have been recognized in previous awards: Carbide and Carbon Chemicals Corp. in 1933, the Organic Chemicals Department of E. I. du Pont de Nemours & Co. in 1935, Monsanto Chemical Co. in 1937, Standard Oil Development Co. in 1939, Dow Chemical Co. in 1941, and Merck & Co. in 1947. During the war two all-industry awards were made—the first in 1943 to the entire American synthetic rubber industry, and the second, in 1946 to more than one hundred companies, universities and research organizations whose chemical engineers participated most effectively in the Atomic Bomb Project.

Significantly, all of these awards have recognized achievements that have contributed to the advance of our industries and profession. Chemical engineers have reason to be proud of this enviable record.

S. D. KIRKPATRICK,
Secretary, Committee of Award

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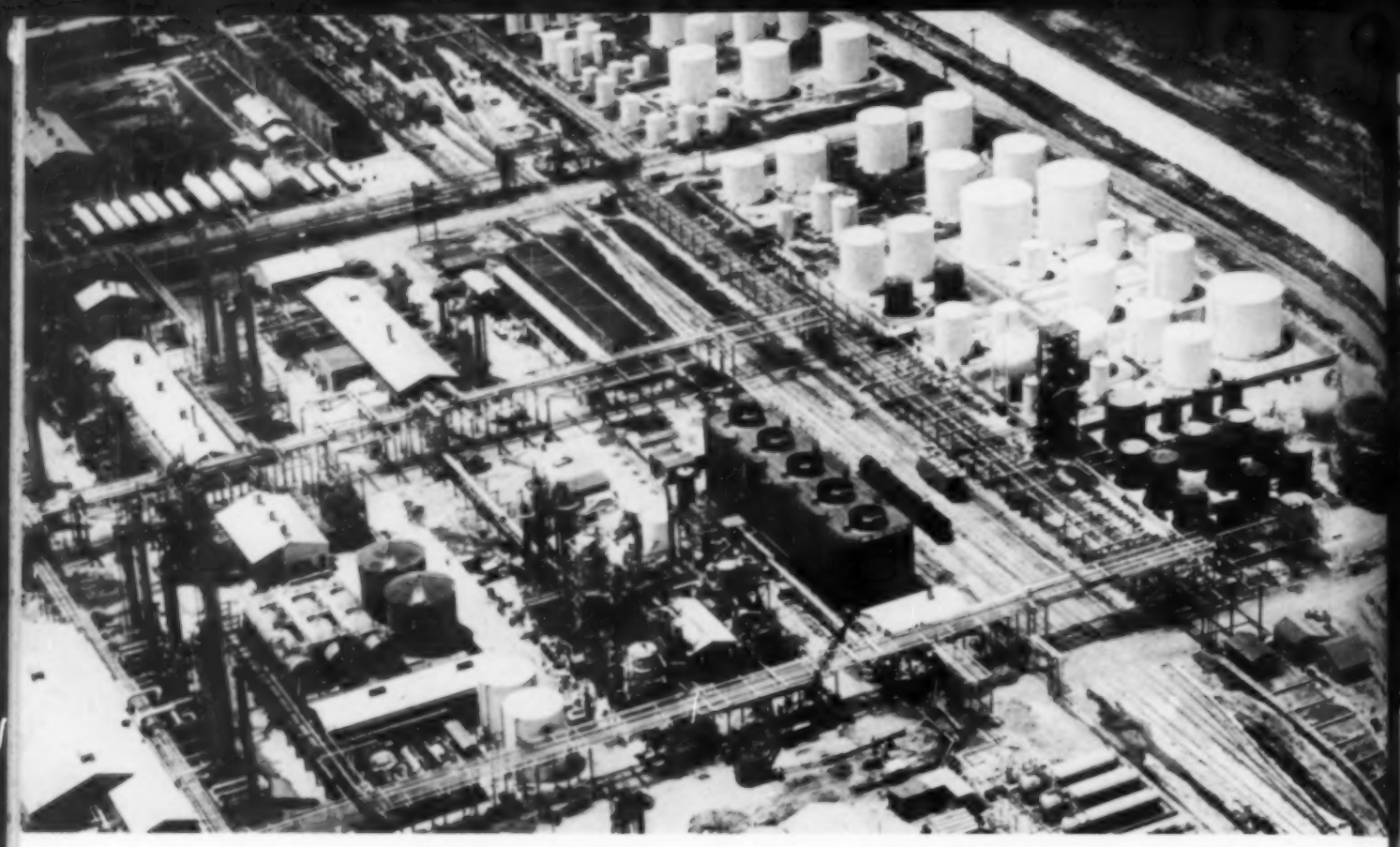


A well integrated petrochemical industry depends on an abundance of readily available raw materials—petroleum hydrocarbons, salt, lime and sulphur. This airview shows how Shell Chemical's newest unit is literally surrounded with facilities for efficient production

Synthetic Glycerine

A MILESTONE IN PETROCHEMICAL PROGRESS

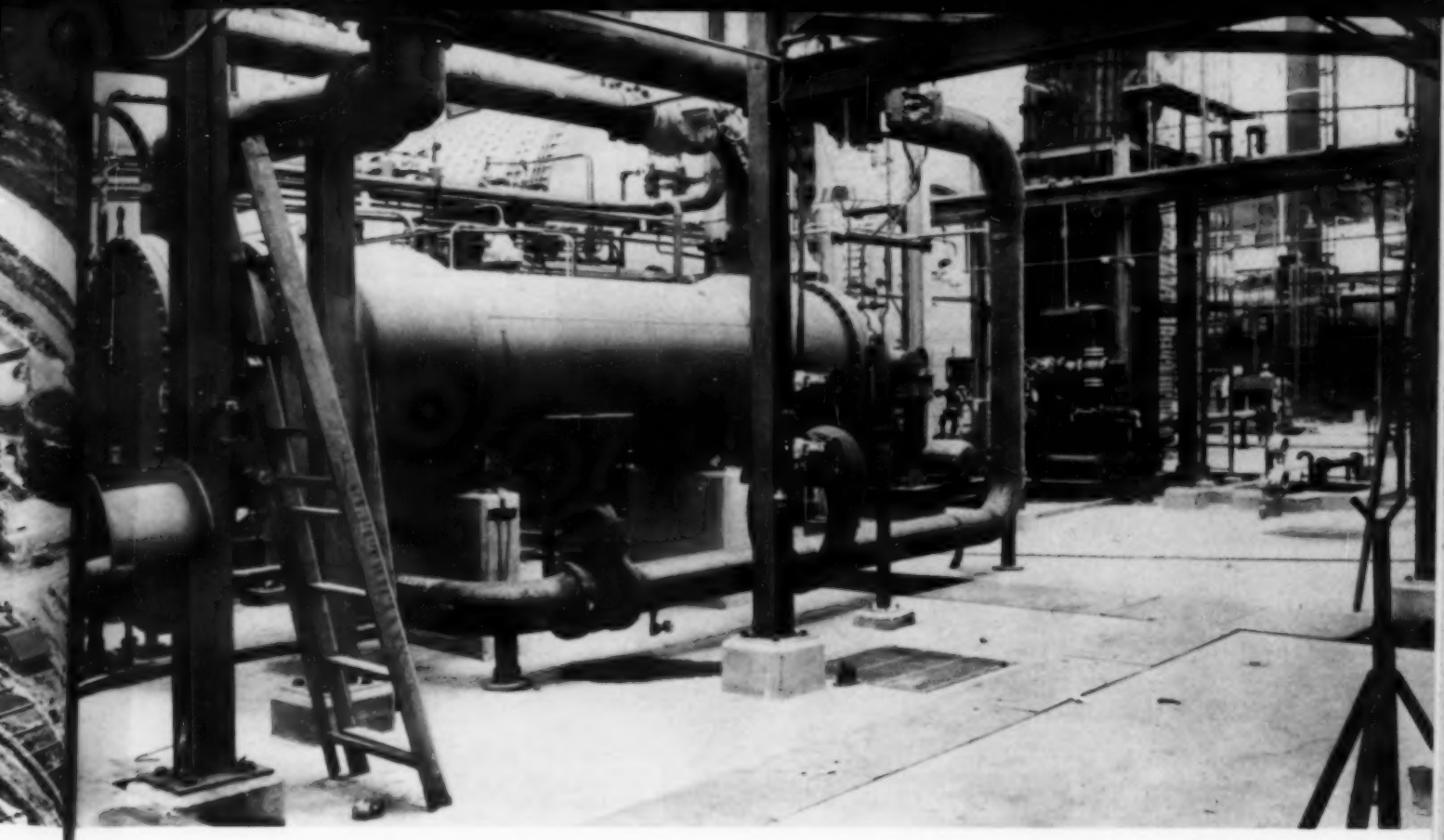
Shell's successful synthesis climaxes a long-time program for building an entirely new industry to make a very old product

FOR MORE THAN A DOZEN YEARS, Shell Development Co. has been engaged in the creation of a new chemical industry based on allyl compounds derived from petroleum hydrocarbons. This comprehensive program of basic research, process development, product evaluation, and engineering design is materializing in an integrated series of chemical plants involving an investment approximating $12 million. During the past three years units for allyl chloride, allyl alcohol, propyl and propylene chlorides, acrolein, diallyl ether, glycerol epichlorohydrin, glycerol dichlorohydrin, and diallyl phthalate have been brought into operation.

A major objective in this program was reached in September with the completion of the world's first plant for the commercial production of synthetic glycerine. Thus there has been provided a primary industrial source for an essential chemical which for centuries has been available only as a byproduct from the manufacture of soap and fatty acids. This process was the result of research by Shell Development Co. and the plant was installed by the Shell Chemical Corp. at Houston, Texas. Its estimated cost is $8 million and its capacity is approximately a fifth of the national prewar output of glycerine.

From Propylene to Glycerine

The synthesis of glycerine has engaged the attention of research workers for years. The hydrolysis of trichloropropane has attracted much futile work. Glycollic aldehyde and nitromethane or formaldehyde and nitromethane have been made to yield glycerine. Acrolein has been oxidized to glyceraldehyde by means of sodium chlorate and the aldehyde in turn reduced to glycerine. Symmetrical dichloroacetone prepared from beta chloropropylene yields glycerine by reduction and hydrolysis. A more recent proposal involved condensation of carbon monoxide and formaldehyde to glycollic acid, reaction of this with a formol, and ultimately alcoholysis of a formaldehyde derivative of glycerine. However, careful chemical engineering evaluations of these and other proposals led Shell to the conclusion that low-cost allyl chloride would



Equipment for the synthesis of the first dilute glycerine solution follows the allyl-chloride unit. Extremely pure raw materials, precise control of temperatures, pressures and reaction concentrations helped Shell's chemical engineers tame this unorthodox process

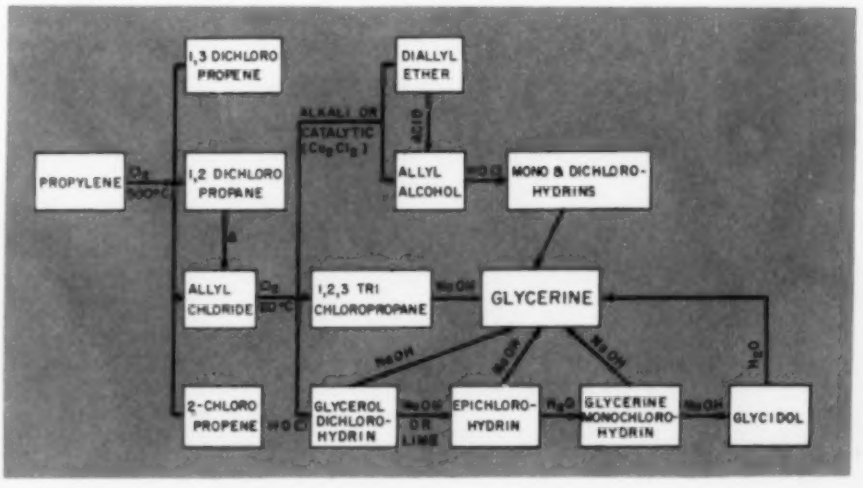
be the key to low-cost glycerine.

The direct substitution of chlorine into the propylene molecule in such a way that the unsaturated bond remained unaffected was, of course, diametrically opposed to all orthodox theories about the general behavior of chlorine in relation to double bonds. Yet through the courageous use of temperatures far above those previously tried, the process was made to work in the laboratories of Shell Development Co. By this accomplishment, the door was opened to a possible process for the commercial production of synthetic glycerine.

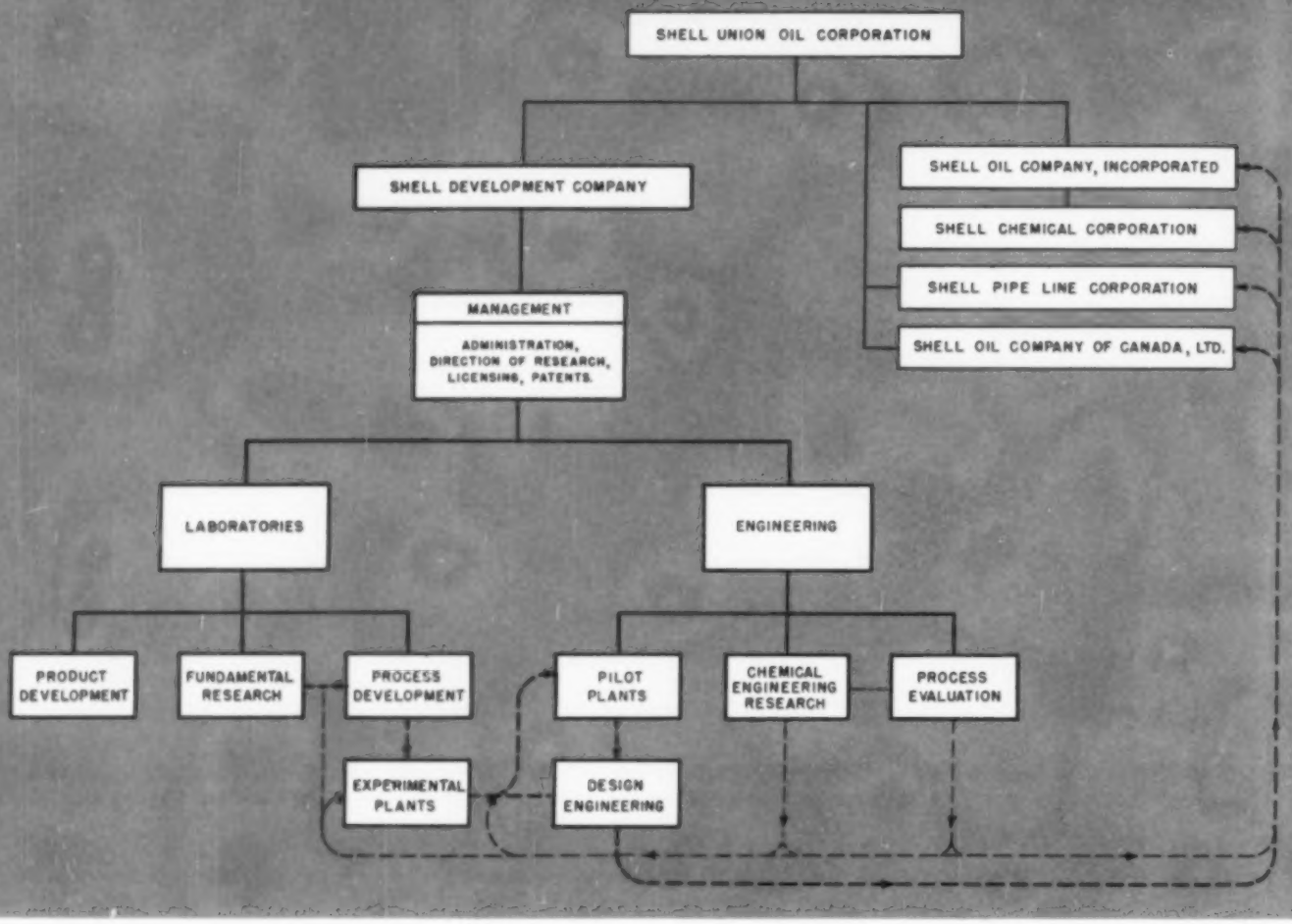
To the chemical engineer, the technical problems resulting from this discovery have been fully as arresting as the novelty of the chemical reaction itself. The engineering hazards of chlorination at 400 to 600 deg. C at first seemed insurmountable. At such temperatures, it is, of course, very easy to get explosive inflammation of the reacting materials — with a final yield of nothing but carbon and hydrochloric acid. The problems of controlling such reactions are formidable. But when conditions are correctly maintained by proper chemical engineering design, the reaction proceeds smoothly in the desired direction with high yields of allyl chloride. Successful solution of the chemical engineering problems involved in the purification of propylene, control of a highly exothermic reaction, and purification of products obtained have been demonstrated on a commercial scale as the result of painstaking development in the laboratory, pilot plant, and engineering offices.

With a successful process for allyl chloride a *fait accompli,* there still remained the problem of determining the best means of proceeding on to glycerine. The accompanying chart shows diagrammatically the various possible methods by which propylene may be converted to glycerine, together with the intermediates and some of the by-products. All of these routes to glycerine were subjected to chemical engineering evaluation in seeking the optimum technical and economic choices for plant design. A large number of process designs were made and dozens of internal process alternatives were given economic study. The ultimate selection was a plant including the steps of chlorohydrination of allyl chloride or allyl alcohol, hydrolysis of the chlo-

From propylene to glycerine is possible via various routes with resulting intermediates and byproducts. These reactions were worked out by Shell Development Company



ORGANIZATION CHART ILLUSTRATING TRANSLATION OF RESEARCH THROUGH CHEMICAL ENGINEERING INTO PROCESSES FOR OPERATING COMPANIES



rohydrins to crude glycerine, and evaporation, distillation and extraction of the crude solution to produce high purity glycerine. (See "Glycerine from Petroleum", by J. V. Hightower, *Chemical Engineering*, September, 1948, pages 96-8.)

But What of the Organization Behind These Achievements?

Shell Development Co. was organized in 1926 for the conduct of research relating to petroleum. It is the research and development affiliate of the Shell operating companies of the United States. Crude oil production and the refining and marketing of oil products are carried out by the Shell Oil Co. and the manufacture and marketing of chemicals by Shell Chemical Corp. (See accompanying organization chart.)

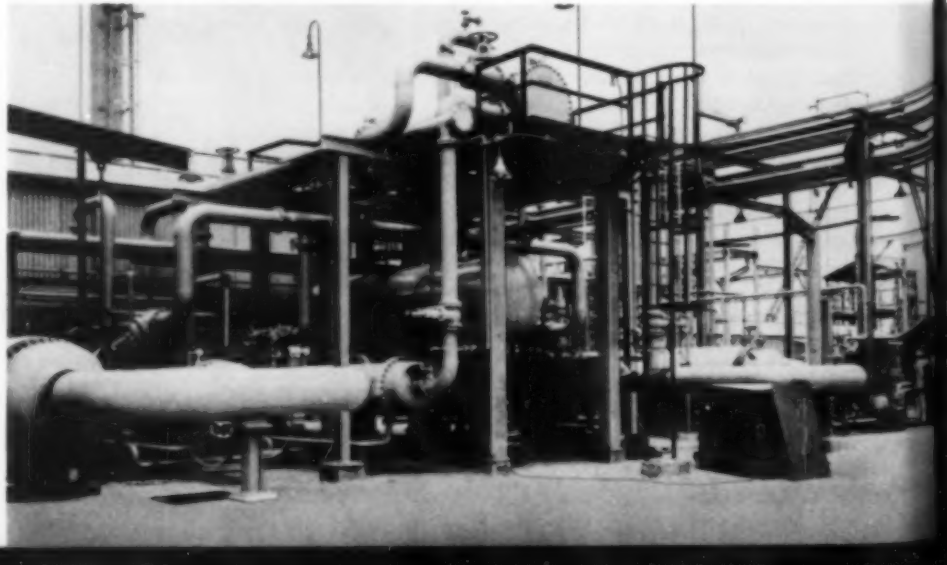
Although new processes are largely the product of Shell Development, credit for industrial accomplishments is always shared with the affiliated companies, since their engineers and technologists have an important part in the construction of plants, and they are ultimately responsible for plant operation and the commercial success of new ventures.

The main laboratories of Shell Development Co. are at Emeryville, Calif.; Administrative offices which include engineering, patent and licensing center in San Francisco and New York.

In the development and application of chemical engineering, fundamental research is strongly stressed because of its importance in furthering advances in technology. For example, catalysis, reaction kinetics, theory of phase equilibria, mass transfer, and fluid mechanics have each been given systematic study. In the laboratories and pilot plants, a wide variety of equipment is available for studying fundamental problems in mixing and agitation, azeotropic and extractive distillation, solvent extraction, and the variables involved in reactor design.

Throughout the years, a guiding principle in Shell Development's approach to process development has been the purification of raw materials before

Engineering hazards in chlorinating propylene at 400-500 deg. C. at first seemed insurmountable. Heat-exchangers of painstaking design and construction were essential



synthesis, in order to obtain a maximum of selectivity, yield, and quality of product. Separation processes have been of determining importance and these are primarily the work of the chemical engineer.

Other Chemical Engineering Achievements

The importance of chemical engineering in the activities of the Shell Development Co. is ultimately measured, of course, by the commercial plants using its processes. The accompanying table lists 53 major processes in chronological order of their first commercial utilization, and also shows the number of plants built or being built for each. The operations listed represent capital investments of over $400 million in plant facilities by Shell affiliates and licensees. To discuss each of these processes even briefly is beyond the scope of this paper. Some of them, however, may be pointed out as landmarks in chemical engineering progress.

Extractive distillation. The unit operation of extractive distillation was introduced on an industrial scale in the process for toluene recovery originated by Shell Development. During the war it produced over 40 percent of all the toluene made from petroleum. Other applications of extractive distillation pioneered by Shell chemical engineers include the purification of butadiene, the separation of butanes from butylenes, and the recovery of isoprene as well as the recovery of benzene, xylenes, and cyclohexane from petroleum fractions.

Aviation Gasoline. Shell has been one of the leaders in the development of aviation fuels. The first commercial production of isooctane came via its cold-acid process from a Shell Oil plant in April, 1934. Thereafter isooctane ceased to be a laboratory curiosity and became a large volume synthetic chemical. As demand for high quality octanes outran the supply of isobutylene, the cold-acid process was succeeded in turn by the hot-acid and alkylation processes, both of which have been widely used throughout the petroleum industry.

When it was foreseen that demand would exceed the supply of isoparafins, isomerization processes were developed and licensed, – principally the vapor-phase process for butane and the liquid-phase process for either butane or pentane.

In May, 1942, based on work by Shell Development, the Norco Refinery of Shell Oil Co. began commercial production of cumene, an aviation fuel component which provides extra power during take-off and in combat. Complete technical information on this process was given without obligation to the Petroleum Administration for War, and eventually 24 plants were committed to this operation. The use of cumene contributed 6.1 percent of the total 100 octane fuel produced for the war program. Of the total wartime production of high-octane fuels, 13 percent came from Shell refineries and an additional 30 percent from other refineries licensed under Shell Development's processes.

Chemicals from Petroleum. Hydrocarbon raw materials available in large quantities from the refining of petroleum led to the search for means to convert many of them into valuable synthetic chemicals. From this work, comprising laboratory and fundamental research, process development and engineering design, an integrated branch of the organic chemical industry has evolved. Thanks to this new industry, solvents and chemical intermediates of high quality have become available for American industry in ever-increasing quantities.

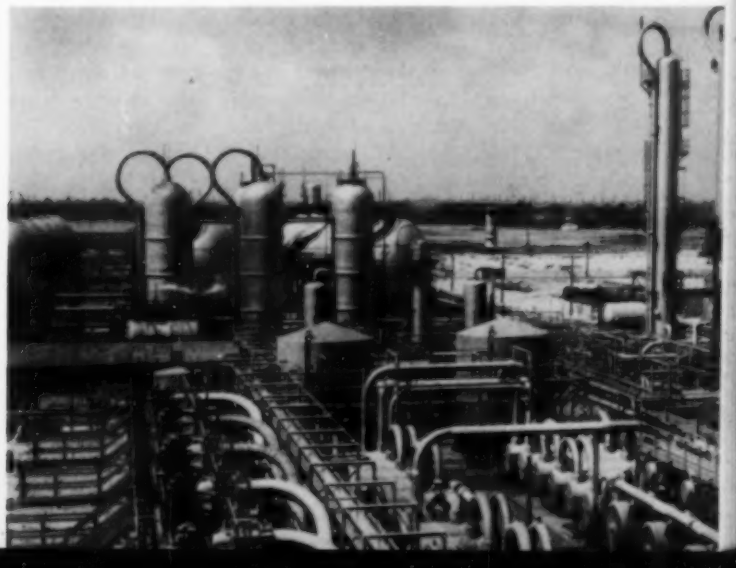
Early accomplishments were processes for the conversion of light olefins in cracked gases to secondary alcohols followed by dehydrogenation of the alcohols to ketones. With the alcohols and ketones firmly established, developments extended to their derivatives. Acetone was followed by diacetone alcohol, mesityl oxide, and methyl isobutyl ketone. Other developments included diisopropyl ether, secondary butyl acetate, diisobutyl ketone, methyl isobutyl carbinol, hexylene glycol, and methylpentadiene.

Synthetic Rubber. Shell was recognized for its contribution to the American synthetic rubber industry in the 1943 Award for Chemical Engineering Achievement. The first commercial production of butadiene from petroleum came from the Houston plant of the Shell Chemical Corp. in 1941. This pre-war plant contributed substantially to the wartime synthetic rubber program both in tonnage of butadiene and in practical demonstration of techniques later used throughout the industry. About one-sixth of all the butadiene produced from petroleum came from Shell's operations, and one or more of its processes and improvements were applied in nearly all of the petroleum butadiene plants.

Synthetic Aromatics. In domestic crude oils, the concentration of low-boiling aromatic hydrocarbons is small compared to that of the low-boiling naphthenes. Dehydrogenation of methyl cyclohexane has been used, therefore, to augment the supply of toluene. In many crudes, however, the five-carbon ring exists in greater quantity than the six-carbon ring. Recognition of this fact led to a process which substantially increased the yield of synthetic aromatics from crude oil. The process consists of precise distillation to prepare a concentrate of the selected cyclopentane homologue, catalytic isomerization of the substituted cyclopentane to the corresponding cyclohexane, catalytic dehydrogenation to the aromatic, and purification by extractive distillation.

In 1945 W P B gave priority for construction of these allyl-chloride and allyl-alcohol units which went on stream shortly after V-J Day

First commercial production of butadiene from petroleum came from Shell's Houston plant in 1941. This one is at Torrance, Calif.



COMMERCIAL OPERATIONS BASED ON SHELL DEVELOPMENT PROCESSES

Representing a Total Capital Investment by Shell Affiliates and Licensees in Excess of Four Hundred Million Dollars

PROCESS OR PRODUCTS	Year of First Commercial Operation	Plants Built or Building for Each Process
*Solvent Extraction of Lubricating Oils	1930	16
Secondary Butyl Alcohol	1930	4
Separation of Pentanes	1932	3
Tertiary Butyl Alcohol	1933	2
Methyl Ethyl Ketone	1933	4
Isooctane, Cold Acid Process	1934	13
Isopropyl Alcohol	1935	4
Acetone	1935	4
Phosphate Process for Removal of Hydrogen Sulfide from Petroleum Fractions	1935	28
Octanes by Hot Acid Polymerization and Hydrogenation	1936	6
Rectified Absorption	1937	5
Petroleum Alkyl Phenols	1937	2
Diacetone Alcohol	1937	4
Mesityl Oxide	1938	4
Methyl Isobutyl Ketone	1938	4
*Alkylation of Paraffins with Olefins	1939	28
*Solutizer Processes for Treating Gasoline	1940	9
Toluene Recovery by Extractive Distillation	1940	11
Butadiene via Dichlorobutane	1941	1
Butadiene Purification by Extractive Distillation	1941	1
Isomerization of Paraffins (Vapor Phase)	1941	8
Dehydrogenation of Butane	1941	1
Cumene	1942	24
Synthetic Toluene	1943	2
Isomerization of Paraffins (Liquid Phase)	1943	5
Butadiene: Selective Removal of Acetylenes	1943	4
"Butrex", Organic Plasticizer	1943	3
Xylidine	1943	1
"Ionol" and "Ionex", Oxidation and Rust Inhibitors	1944	1
Extractive Distillation for Separation of Butanes from Butylenes	1944	7
Gasoline Hydrogenation	1944	7
Diisobutyl Ketone	1945	1
Penicillin Recovery Process	1945	4
Trichloropropane	1945	1
Allyl Chloride and Allyl Alcohol	1945	2
"D-D", a Soil Fumigant	1945	2
Methyl Isobutyl Carbinol	1945	3
Acrolein	1945	2
Diallyl Ether	1945	1
Synthetic Xylenes	1945	2
Synthetic Cyclohexane	1946	2
Ortho Xylene	1946	1
2, 3, 5-Trimethylphenol	1946	1
Hexylene Glycol	1946	2
Methylpentadiene	1946	1
Dimethylsulfolane	1946	1
Synthetic Benzene	1946	2
Glycerol Epichlorohydrin and Glycerol Dichlorohydrin	1946	1
Diallyl Phthalate	1947	1
Di-tertiary-butyl Peroxide	1947	1
Ethyl Alcohol, Direct Hydration Process	1948	1
Ethyl Chloride	1948	2
Para Xylene	1948	1
Synthetic Glycerine	1948	1

*Processes developed and licensed jointly with other companies.

This process, first applied to toluene production, has been used in two plants that sent to war 60,000,000 gal. of toluene, and in a third plant that was under construction when the war ended. Since V-J Day, the process has been extended to the production of benzene, xylenes, and cyclohexane.

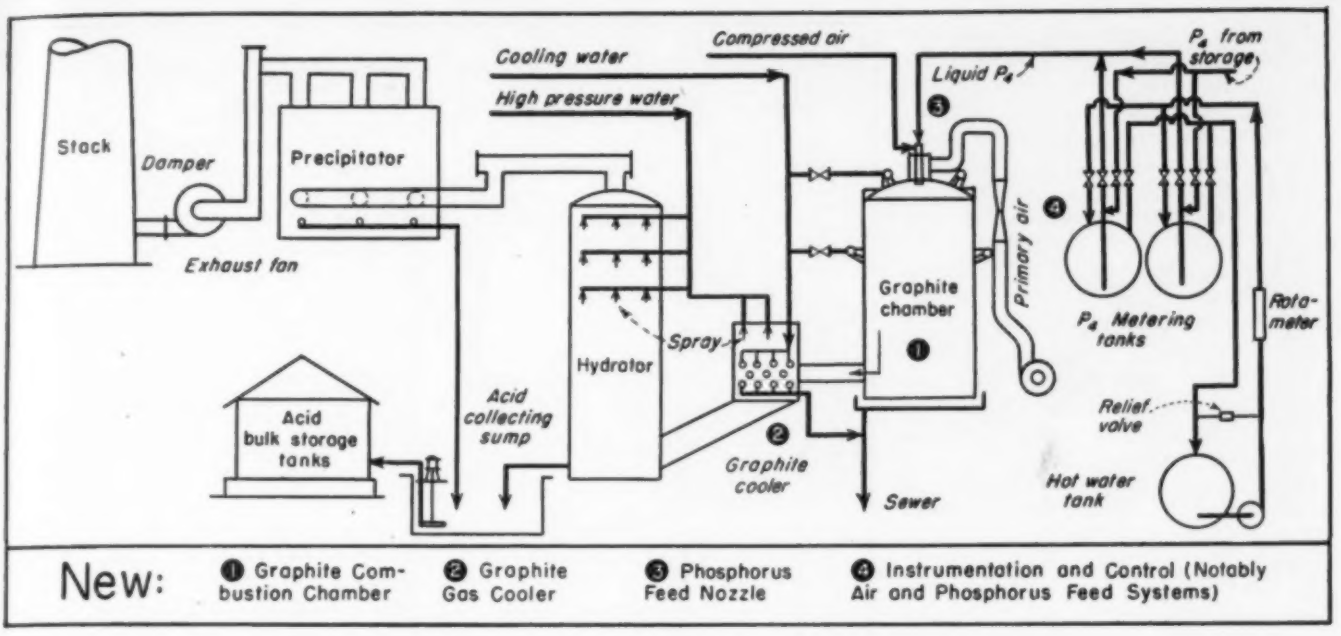
Ethyl Alcohol. During the past two years, Shell Development has been engaged in the processing, design, and construction of a plant which will add 25 percent to the national capacity for synthetic ethyl alcohol. Although the synthesis of ethyl alcohol from ethylene has been accomplished by others in the conventional process of absorption in sulphuric acid followed by hydrolysis, the new Shell Chemical plant which began operating in August, 1948, presents the first commercial synthesis by means of direct catalytic hydration of ethylene. In this development, formidable chemical engineering problems were met and solved in the design of reactors for highly exothermic reactions which must operate continuously at high pressure and temperature under severely corrosive conditions. In the recovery and purification of ethylene, a novel distillation process was devised which has decisive advantages over the conventional methods.

Allyl Derivatives. As previously pointed out the discovery of substitutive chlorination of propylene in the laboratories of Shell Development Co. opened the door to the production of low-cost allyl derivatives. Even before the war an integrated group of allyl derivatives had been developed through studies in the laboratory, pilot plant, and product application. There remained a number of obdurate chemical engineering problems in the transformation of small-scale to full-scale design when the pressure of war activities forced postponement.

During the last year of the war, the War Production Board gave priority to plants for allyl chloride, allyl alcohol, and "D-D", a new soil fumigant. Shortly after V-J Day, the first volume production of these compounds was obtained from the new Houston plants of Shell Chemical Corp. These projects have been followed in turn by plants for acrolein, diallyl ether, glycerol epichlorohydrin, glycerol dichlorohydrin, allyl esters, and a second plant for allyl chloride. And now there has been reached a climaxing stage in this program with the completion of a plant for the commercial production of synthetic glycerine. Several other products less familiar at present promise to assume comparable significance in the future.

Design already is under way for future plants which will continue Shell's exploitation of the chemistry of allyl compounds. Product evaluation is going forward on over 30 products, many of which will undoubtedly be selected for commercial production. With these products available as low cost intermediates, an array of new materials may be expected for application in surface coatings, plastics, fabrics, pharmaceuticals, and other chemical products.

Synthetic glycerine is but a significant milestone passed in the onward march of chemical engineering in the petrochemical industry.



TVA Phosphoric Acid Plant Sports a New

Phosphorus Combustion System

Graphite combustion chamber represents bold departure from old ceramic-lined chambers. With this and other innovations, TVA gets a more concentrated acid —with less operating trouble, less corrosion and less labor.

L. H. Almond and H. K. Steinbiss

Respectively, Chief and Chemical Engineer, Chemical Plant Design Branch
Tennessee Valley Authority, Wilson Dam, Ala.

SINCE the first manufacture of concentrated phosphoric acid at its fertilizer works at Wilson Dam, the TVA has contended with a great number of problems in the design and construction of equipment resistant to highly corrosive substances at elevated temperatures. Not the least of these problems has been that of burning elemental phosphorus to P_2O_5 in a combustion chamber adequately cooled to prevent rapid deterioration.

Prior to the design, construction, and operation of the equipment in use today, first consideration was given to burning gaseous products from the phosphorus furnaces directly, or introducing, volatilizing, and burning phosphorous sludge (impure liquid phosphorus). Both of these methods required the disposal of residual slag. Early work of this nature and phosphoric acid plant operation have been described in previous articles.[1,2,3] The present day acid plant design, however, had to wait on improvements in phosphorus furnace design and operation to the point that clean, practically pure, phosphorus was assured.

When furnace changes were made and operation was improved to assure a constant supply of 99.6 percent or better phosphorus, design changes in combustion chamber construction and operation were practical. Slag formation resulting from impurities in the phosphorus was no longer a factor affecting design.

This article describes the design and operation of a new phosphorus combustion system keyed to a graphite combustion chamber. It represents the latest development of the Authority in this field. The new equipment, in addition to the combustion chamber, consists of a graphite tube water-cooled heat exchanger, an improved burner nozzle, and such additional controls as the phosphorus and air metering systems. The rest of the equipment — hydrator, precipitator, and exhaust system—remain as described earlier.[1,2,3]

Graphite Combustion Chamber

The choice of graphite, as a material of construction for the new combustion chamber, was based on its excellent thermal properties and its resistance to hot oxidizing atmospheres containing P_2O_5 vapors. The thermal conductivity of graphite is about 20 times that of ordinary carbon. Its coefficient of heat transfer is 75 compared with 26 for steel and 220 for copper.

The use of graphite was a radical departure in combustion chamber construction in that it is a readily oxidizable substance at temperatures above 800 deg. F. Consequently, provisions had to be made to keep the temperature of the exposed surfaces below 800 deg. F. to prevent the combustion of the graphite itself. Outside water cooling was provided for this purpose.

Design calculations indicated that

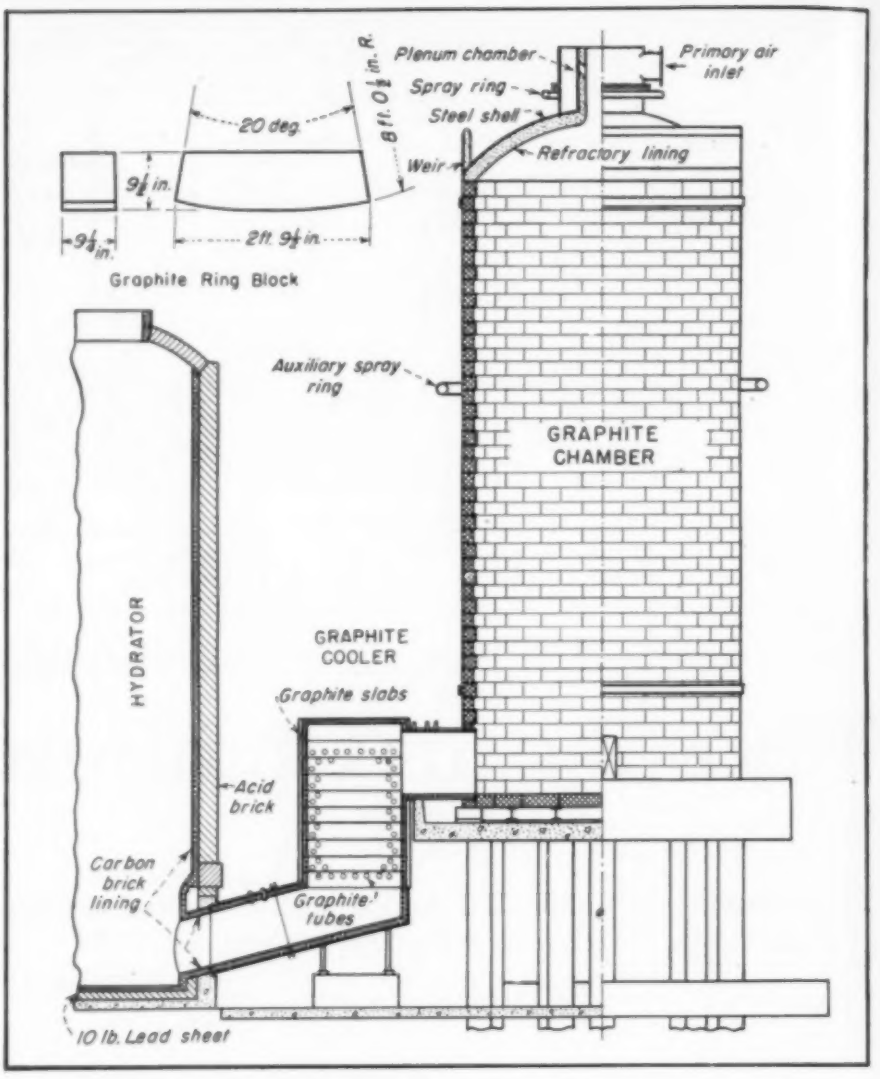
it should be possible, by cooling the outer surface of the combustion chamber, to hold the surface temperature of the inner wall below 300 deg. F. Allowing for any reasonable error in the data on which these calculations were based, the anticipated temperatures of the graphite wall at all points would be well below the danger point of 800 deg. F. A study of operating data sheets reveals that the expected temperatures were approached but seldom exceeded.

The combustion chamber is simply a hollow tower, 16 ft. in diameter and 34 ft. along the vertical graphite block wall, with graphite block base, and a monolithic cast refractory dome. Each course of the chamber consists of 18 of the graphite ring blocks joined together with Asplit-F cement in the 3/32-in. joint spacing between blocks. Each block, whether in the base or in the wall, is machine-cut to within 1/32-in. of required dimension to insure a close fit and to reduce possibility of failure of leakage through the joints. Asplit-F, a chemical hardening resin cement, has proved to be effective in resisting attack by the hot P_2O_5 vapor and metaphosphoric acid that in the past resulted in destruction of refractories and refractory cements alike.

The combustion chamber dome consists of a ½-in. steel plate head with an 11-ft. curvature radius lined with a 9-in. thickness of monolithic precast refractory of lumnite cement and grog in the ratio of 1 to 7. The dome rests on and is completely supported by the graphite walls. Resistance to corrosive attack and to disintegration by heat is the outstanding special characteristic of lumnite. The grog is an aggregate of crushed firebrick having about the same coefficient of expansion as the lumnite cement. Monolithic refractory castings of this type have been used successfully as domes for the TVA phosphorus smelting furnaces; such usage indicated that similar castings might be suitable for combustion chamber service and this has been proved by 2 yrs. of near continuous acid plant operation. The single burner nozzle port, an integral part of the refractory casting, is centrally located on top of the dome. A concrete weir around the dome periphery is of sufficient height to retain a reservoir of water which covers the greater part of the dome surface.

The chamber base is cupped in a shallow pan which is constructed of ½-in. A.I.S.I. Type 316 stainless steel and is supported by wide flanged beams that are anchored horizontally in a concrete basin so that the bottom 2 in. of the pan are in water constantly. Flashing, of ¼-in. Type 316 stainless steel, set into the first course of graphite block and skirted over the pan lip, deflects the water that cascades down the wall and eliminates the possibility of water seepage into the chamber base. As a further precaution against the possibility of seams opening along the vertical wall, two spring loaded bands are placed around the chamber, one at the top and the other within a few feet of the base.

Cooling water, from a spray ring surrounding the central dome opening, covers the dome surface, overflows the weir, and flows filmwise down the sides of the chamber wall. The amount of water required varies with the phosphorus burning rate, climatic conditions, and seasonal process water temperature. Provisions have been made to supply in excess of 1,500 gpm. of water for both combustion chamber and gas cooler operation. Tests, however, indicate that 1,200-1,300 gpm. will give satisfactory cooling when phosphorus is burned at the usual operating rate of 2,500-2,700 pph. at summer ambient atmospheric temperatures of about 90 deg. F. and summer cooling water temperatures of 80-85 deg. F. Plant operators are instructed to keep all graphite wetted at all times. To ensure complete wetting, an auxiliary spray ring was installed around the tower and is brought into play whenever the operator finds it impossible to wet the vertical graphite surfaces completely by the overflow from the dome weir.

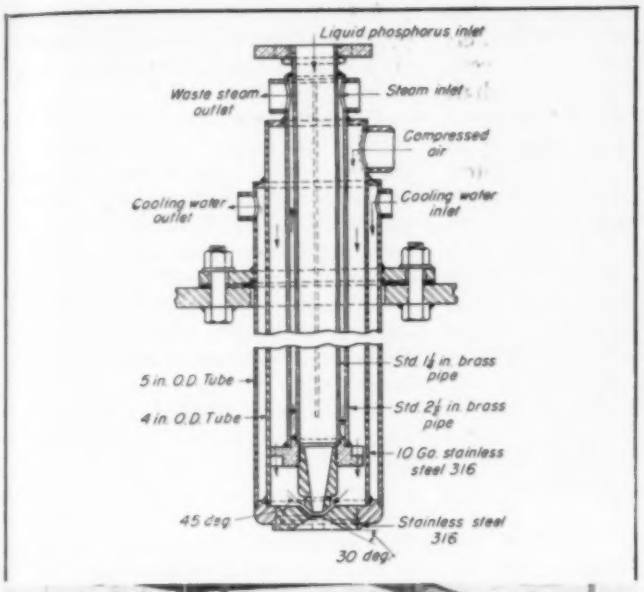


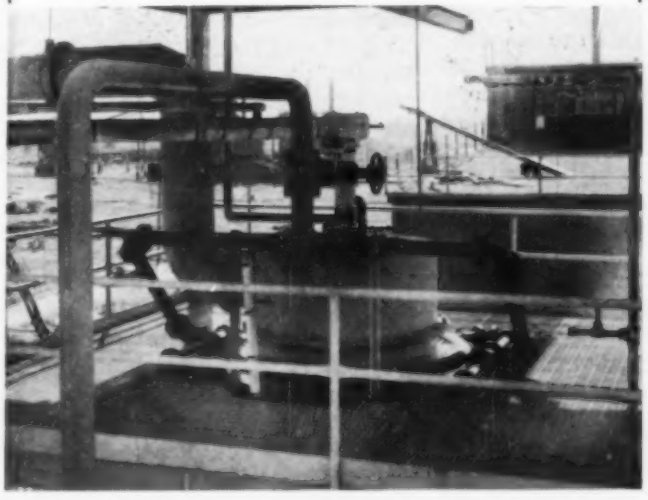
1. Graphite Combustion Chamber is TVA's pride and joy. It is vastly superior to old refractory-lined chambers in resistance to hot P_2O_5 gas.

Four improvements make TVA's phosphoric

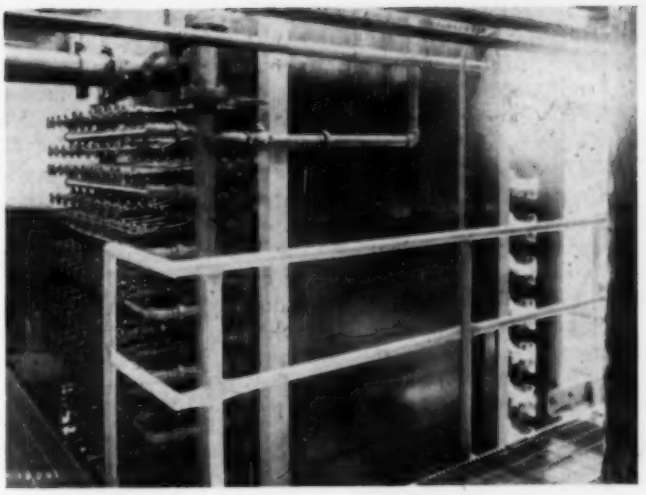
Phosphorus Feed Nozzle

The phosphorus feed nozzle at the burner also is a TVA development that contributes much to smooth and successful operation. The nozzle consists of an inner tube, through which phosphorus at 135-140 deg. F. and 25 psig.

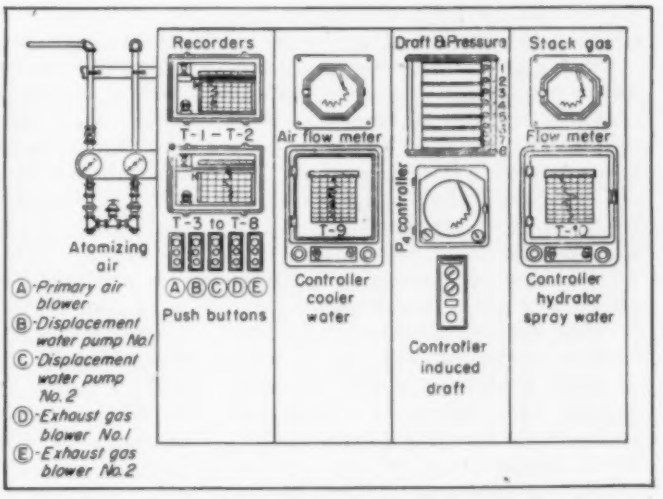




2. Feed Nozzle doesn't plug, gives complete combustion. Photo shows nozzle connections, top of combustion chamber.



3. Gas Cooler boosts concentration of acid. Reason: less cooling, and concomitant dilution, in the hydrator.



4. Instrumentation and Control, all from this one board, have reduced labor to one operator per shift.

acid plant more efficient and less troublesome.

flows, surrounded by three annular spaces for steam, air, and water, respectively. The steam chest surrounding the phosphorus tube supplies the heat necessary to keep the phosphorus in a molten state during normal operation and to prevent clogging during shutdown periods. The steam enters at one side of the chest, the annular space being baffled into a two pass arrangement, and waste steam and condensate leave at a point diametrically opposite. Compressed air piped to the second annular space flows downward through a plate slotted at an angle to impart rotation to the air stream entering the space around the phosphorus jet. The opening between the nozzle tip and phosphorus jet is constricted in order to increase considerably the velocity of the air at the point where it meets the stream of phosphorus. A swirling motion is given to the phosphorus as the liquid stream is broken up into droplets under the force of the rotating compressed air stream. Water flows through the third annular space or outer jacket to cool the part of the nozzle that is exposed to the high temperature of the combustion chamber gases.

At a phosphorus feed rate of 2500 pph., approximately 17,500 pph. of air is required to supply a 25 percent excess of air over that stoichiometrically required for complete combustion of the phosphorus. Of this amount, but five percent or about 800 pph. is required as compressed air to atomize the phosphorus. The main bulk of air, primary air, is metered through a venturi and is piped to the plenum chamber that encompasses the burner nozzle port or block wherein is located the phosphorus feed nozzle. Downward-angled slots in the burner block permit entry of the air and resultant mixing with the atomized phosphorus inside of the chamber proper. Primary air is supplied by a single blower of 5000 cfm. capacity at 12 in. static pressure. Air throttling is accomplished by a damper in the blower intake duct.

Gas Cooler

The hot gases from the combustion chamber are cooled in a graphite shell-and-tube cooler located between the combustion chamber and the hydrator. The gases enter one side of the cooler through a short length of 40-in. I.D. stave duct made up of 3-in. thick slabs of graphite, pass downward normal to the staggered water-cooled tubes, and pass out of the bottom to the hydrator through a carbon-brick-lined steel duct of 33-in. I.D. The cooler itself is made up of 3-in. I.D. by 4-in. O.D. by 68-in. long graphite tubes that are enclosed in a rectangular graphite shell made of 3-in. thick graphite panels. The tube

ends project from the sides and are individually valved to the water supply to permit continued use of the remaining tubes should one or more tubes fail. Cooling of the shell is accomplished by a film of water flowing down the sides from sprays located on top and around the top perimeter of the cooler box. Obviously the same precautions for cooling graphite surfaces that were outlined for the combustion chamber wall, apply equally well to all parts of the gas cooler.

Further cooling of the combustion products, in addition to that effected by the cooler shell and tubes, is obtained by direct contact with a water spray from nozzles set into the roof of the cooler. The principal purpose of this spray, however, is to bathe the tubes and keep them free of viscous metaphosphoric acid that otherwise would coat the tubes and destroy the effectiveness of the heat exchanger.

Operating data have recorded cooler inlet and outlet gas temperatures within a 100 deg. F. range of 1400 deg. F. and 400 deg. F., respectively, at a phosphorus burning rate of 2,750 pph. At lesser burning rates these temperatures are correspondingly lower, but the 1000 deg. F. temperature drop effected by the cooler holds quite closely and meets design expectations.

With the new combustion chamber and cooler, the gases enter the hydrator at much lower temperatures than in previous installations.[8,9] Less spray water, above the fixed quantity needed for hydration of P_2O_5, is required for cooling to yield acid of 82-86 percent H_3PO_4 content collected at 180-200 deg. F. The larger quantities of spray water required for cooling in the old systems resulted in the manufacture of an acid of approximately 78 percent concentration that was collected at 230-260 deg. F. By using less water, acid of present day strength was manufactured in the old systems but only at the expense of rapid deterioration of equipment due to the corrosive action of acid and hydrator gases at temperatures in excess of 300 deg. F.

The only effect of the new system on the electrostatic precipitator is, because of the smaller amounts of excess air and hydration water used, that the incoming gases have a higher concentration of acid mist for a given tonnage of acid recovered; this leads to increased efficiency in acid recovery and results in smaller stack losses. The lower temperatures of the incoming gases (170-190 deg. F.) serve to decrease the maintenance requirements on the precipitator frames and to lessen the frequency of replacement of electrode wires.

The gases leaving the precipitator are drawn through 33-in. I.D. wooden stave ducts to induced draft blowers that exhaust to the stack. The blowers, the sole source of the induced draft across the acid system, consist of 2 units, each of 6000 cfm. capacity at 10 in. H_2O static pressure, the rotors of which are encased in volutes made up of specially cut carbon blocks. A sliding gate across the inlet of each permits alternate use in case of shutdown for repairs. A damper placed in the duct preceding the blower controls the draft so as to keep the combustion chamber on a slightly positive pressure at all times. The stack is constructed of reinforced concrete lined with acid resistant brick. The waste gases leave the precipitator at approximately 150 deg. F.

Instrumentation and Control

Instrumentation and automatic control on the latest acid plant are considerably more complete than in previous plants.[4] The present installation has simplified operations to such an extent that but one operator is required per shift per acid plant. Instrumentation, centralized at a panel board such as the one illustrated, consists of:

1. Temperature recorders connected to Chromel-Alumel thermocouples for high temperature (1000-2600° F.) measurement, and Iron-Constantan thermocouples for low temperature (0-1000° F.) measurement. The temperatures recorded are that of the combustion gas inside the combustion chamber dome (T-1), combustion gas leaving the chamber (T-2), cooler outlet gas (T-3), precipitator outlet gas (T-4), combustion chamber graphite wall one inch from inside surface at four points (T-5 through 8), and cooler effluent water (T-9).

2. Controller recorders for regulation of, (a), hydrator water to sprays, (b), draft on the combustion chamber, and, (c), phosphorus feed to the burner nozzle. The hydrator outlet gas temperature (T-10) is recorded by an instrument that controls the water flow to the hydrator sprays. A Smoot regulator on the draft control regulates a damper located in the exhaust duct. When on automatic control, it is activated by the pressure of the combustion gases leaving the combustion chamber. A rotamatic recording controller records the flow of displacement water through a remotely located rotameter to the phosphorus tank. Setting the control at the panel board automatically regulates phosphorus flow to the burner nozzles.

3. Indicating draft and pressure gages to indicate the induced draft at various points in the gas flow system, (P-1 to 4), and to indicate the water pressure at the hydrator spray nozzles, (P-5), and in the high pressure water mains, (P-6).

4. Flowmeters to record the air and exhaust gas flows. The air flowmeter measures the differential pressure across a home built venturi in the primary air duct. A similar flowmeter measures the pressure drop across an orifice plate placed in the exhaust duct immediately before the stack. In each case, a conversion chart enables the operator to determine the cfm. flowing.

5. Pressure activated mercoid cutoff alarm switches to stop the displacement water pump and sound a warning alarm in event of failure of cooler cooling water pressure, primary air supply, or hydrator spray water pressure.

Metering of liquid phosphorus to the burner is accomplished indirectly by regulating the hot water displacing the phosphorus in the feed tanks. The phosphorus feed system consists of two phosphorus tanks, a hot water storage tank, two displacement water pumps, interconnecting piping, and a rotameter. The piping and the two pumps are arranged so that with either pump drawing hot water (140-145 deg.) from the tank, the water is metered through a rotameter to either of the phosphorus storage tanks thereby displacing liquid phosphorus to the nozzle located on top of the combustion chamber. The pump capacity is greater than required and the excess is by-passed back to the tank through a relief valve; in this way, a constant pressure of approximately 25 psig. is assured on the displaced phosphorus at the burner nozzle.

Growing Pains

As can be expected in all experimental plants incorporating ideas and materials of construction differing from previous experience, the inevitable operational difficulties appeared. Some trouble was expected when, in February, 1945, the new graphite combustion chamber and cooler were installed at acid plant No. 2. Inside of 18 months after initial operation, however, all the principal trouble-making factors had been uncovered and the corrections were incorporated into a second unit known as acid plant No. 2M which went into operation in October 1946.

Originally, the No. 2 graphite combustion chamber had been constructed with a lower or hearth section in which were located two phosphorus feed nozzles for up-burning of phosphorus. Despite prior knowledge of the destruction of refractories by P_2O_5 vapor at elevated temperatures, the hearth

section was fabricated with a refractory lined steel shell which was water-cooled externally. It was believed that an adequately cooled refractory would require but infrequent relining, and it was feared that graphite in the immediate region of the burner nozzle would rapidly oxidize or deteriorate due to direct flame impingement. Operation, however, showed the opposite to be true. The original refractory lining deteriorated rapidly, and had to be replaced twice within a one-year period. During this time, metaphosphoric acid seeped between the refractory brick and corroded the steel shell to the point where the graphite tower resting on the shell was endangered.

Examination of the graphite block above the hearth section showed that the individual blocks were in as good a condition as when installed, despite the extremely severe operating conditions to which they had been subjected. Consequently, the refractory and steel hearth section was replaced with graphite blocks. The subsequent operations proved that graphite exposed to high temperatures under oxidizing conditions will stand up provided that heat dissipation through the block is adequate.

The first burner nozzle arrangement of two nozzles located diametrically opposite each other 4 ft. above the base of the graphite tower operated successfully enough to warrant description. A lower displacement water pressure was required to deliver the required phosphorus flow to the nozzles, but the air supply was more complex than in the present system. From the single 5000 cfm. blower, duct work was so arranged that primary air was piped to the nozzle plenum chambers and secondary air was piped to two tangential inlets located at the same elevation but spaced 90 deg. from the nozzles. Air throttling was accomplished by gate valves fitted into each of the four branches at the combustion chamber connections. This system was abandoned when other operational difficulties discussed below made several changes necessary.

As originally erected, the No. 2 cooler rested on top of the hydrator and was connected to the top of the combustion chamber by a 42-in. I.D. refractory brick-lined gas duct. This inverted-J-shaped gooseneck was supported by steel framework; it had a fixed connection to the cooler and was roller mounted at the combustion chamber seal to permit expansion within the seal. This expansion provision, however, proved inadequate, as evidenced by the gradual disintegration of the relatively fragile graphite panels and tubes of the cooler. Within 18 mo., maintenance became so excessive that the tubes were removed and the cooler was used exclusively as an externally water-cooled gas duct. Obviously, this procedure threw an additional cooling load on the hydrator and resulted in the production of a hotter and less concentrated acid.

During the early months of operation, the cooler effluent water flowed by gravity to the combustion chamber dome spray ring to serve as cooling water for the chamber walls. The heated water was pumped from the base of the chamber to an atmospheric cooling tower and was recirculated to the acid plant. Pulsations in the phosphorus combustion within the chamber which resulted in P_2O_5 vapor blows at the gooseneck seal and out of cracks in the cooler walls turned the cooling water slightly acidic and caused corrosion and pitting of the steel shell of the dome. Thereafter, recirculation of water was stopped in favor of once used raw river water. Leaks difficult to locate, however, had opened which permitted water to get to the refractory dome lining and had caused irreparable damage.

The point was finally reached where cooler and dome replacement were necessary. Rather than continue with the then existing unsatisfactory arrangement, the No. 2 unit was remodeled to conform with 2M construction, thereby adding the desirability of countercurrent flow of spray water and burner gases in the hydrator. This work was completed recently.

Tomorrow's Problems

Except for minor differences, acid plants 2 and 2M are now identical in operation and purity and concentration of acid produced. In the down-burning procedure, however, there is ever present the possibility of phosphorus particles passing out of the combustion chamber unconsumed and eventually showing up in ultimate plant products. Although no visibly-sized particles of phosphorus have been discovered, nevertheless, "red acid," an indication of finely dispersed phosphorus in the acid, had been observed in the past when the plants were pushed to a burning rate in excess of 2800 pph. of phosphorus.

Recently, with improved operating technique, phosphorus burning rates have been increased to approximately 3000 pph., but such operation requires extra vigilance on the part of the operator to maintain temperature control and the proper balance of air and phosphorus. Obviously there must be a limit to the burning rate that can be attained in the present combustion chambers. It is believed that the maximum burning rate has been reached or is being closely approached because of the limitations of the combustion chamber volume. At a "safe" rate of 2500 pph. the acid plants run very smoothly with a minimum of attention and little or no danger of "red acid" production.

The formation of metaphosphoric acid in the combustion chambers has always been a troublesome problem that to this day has not been solved completely. In the original No. 2 graphite combustion chamber this viscous glass-like substance coated the burner walls, and settled to the hearth where it flowed out a tap hole to a trough leading to the acid sump. The meta acid flows easily when hot but at temperatures below 400 deg. F., it becomes increasingly viscous and at atmospheric temperatures, it sets up to resemble turbid glass.

At the start up of the 2M unit, meta acid deposited on the tubes of the gas cooler to such an extent that within a period of a few hours, the cooler was seriously plugged. Two sprays were then inserted in the cooler roof and water flow adjusted to bathe the tube surfaces to keep them clean. The meta acid thus removed is not completely hydrated but collects in the bottom of the hydrator where the drain tap requires frequent "rodding" to prevent plugging. Once deposited in the acid sump, the meta acid is slowly hydrated to the ortho form.

Heavy scale deposition is taking place on the external walls of the combustion chambers and is caused by precipitation of impurities in the untreated river water. Eventually a descaling operation will be necessary to maintain heat transfer.

The present graphite combustion chamber acid plants are by no means considered ideal. The complete loss of the heat of combustion has always been a source of annoyance and presents a challenge to the engineer to utilize the dissipated energy.

Acknowledgment is made to C. J. McFarlin, now with Air Reduction, for his participation in the conception and design of this graphite combustion chamber.

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Ice storage bin in a chemical plant. There ought to be more of them, says the author.

ICE How and When to Use It In Chemical Processing

For direct cooling in batch processes, ice is ideal; it costs little and has high latent heat. And it needs no coils, jackets or special instruments.

Elliott Spencer
Sales Engineer, York Corp.
New York, N. Y.

HOW CAN ice be used as a refrigerant in chemical processing? We shall try to answer this question here and now. We hope that with the information we give him in answering it the chemical engineer will be better able to pick the right refrigeration for his particular process. For the chemical engineer, faced with the problem of removing the heat generated by a chemical reaction, often turns, like most of us, to methods he is familiar with. As a rule, these are the methods of indirect refrigeration that call for jackets or cooling coils. Direct cooling with ice may not occur to him. Hence he may not always decide upon the most economical and best suited refrigeration method for his process.

Refrigeration of solutions can be accomplished by either direct or indirect cooling. Direct cooling is effected by mixing ice[1] or cold water[2] with the ingredients in the solution. The same result can be secured by precooling one or more of the components before mixing. In direct cooling, the mixture being cooled often is insoluble in water and is later separated from it. Indirect cooling is done by circulating a cold fluid (brine, ammonia, Freon, water or other refrigerant) in the jacket or coils of a reaction vessel.

For direct cooling, cold water from a local well is often available at 50 to 60 deg. F. Sometimes such water cannot be had. Again, it may be unsuited to the particular application; or it may not be cool enough. Then the water must be cooled by mechanical means.

Cold reactants are obtained by cooling before mixing (mechanical precooling). They are also obtained by exposing the reactants to a prevailing low outside temperature. The chlorine industry uses this last expedient.

In the chlorine industry, large volumes of sodium hydroxide are mixed with chlorine to form sodium hypochlorite. The sodium hypochlorite, or soda bleach, must contain from 10 to 18 percent available chlorine by volume. This is necessary since the hypochlorite is used as a bleach in the textile industry, in laundries and in other chemical applications. While the solution is often diluted to lower strength before using, the higher concentration decreases storage bulk and cuts shipping costs. During the chlorination, much heat is given off.

[1] Cold brine may be substituted when lower temperatures are required and when the presence of a salt is not detrimental.
[2] Salt ice or other eutectics may be used where required for lower temperatures, where the presence of salt is not detrimental. Flakice can be produced at a temperature of 22 deg. F.

Soda-bleach manufacturers precool the sodium hydroxide to a temperature low enough to insure that during the reaction the temperature does not rise above 80 deg. F. By holding down the temperature, decomposition is prevented. Decomposition increases with temperature. In the summer, precooling is done by mechanical means. In the winter, the sodium hydroxide tanks are exposed to the cold temperatures outside. Incidentally, to avoid contamination from iron compounds (which affect the decomposition of sodium hypochlorite solutions), chlormation is carried out in concrete tanks or ceramic vessels.

It may be well to pause at this point and inject a word of caution. Before you establish the heat load, you should make actual tests of the heat evolved during a reaction. For if you get your heat-of-reaction data from a handbook, you may wind up with large errors in the calculations. These errors are somewhat dependent on the reactants. When the heat evolved per pound of material is small and the heats of reaction of the various components are small, the error may be quite large. If we multiply this error by the number of pounds of solution involved in the reaction, we get a large error in the calculated heat load. Let us look at an example:

Suppose we have 20,000 lb. of reactant A and we mix it with 20,000 lb. of reactant B to get a product AB that weighs 40,000 lb. Let us assume that reactant A has a heat of reaction of 60; reactant B, a heat of reaction of −58 Btu. per lb. Let us say that the error in the data is 1 Btu. The total heat change will be 2 Btu. ±2 Btu.—a total error of as much as 100 percent. Clearly, with 40,000 lb. of materials involved, the error in Btu.'s would be great.

Direct or Indirect?

How can you decide whether to use direct or indirect cooling in your process? In particular, how do you know when the use of ice is indicated? Perhaps the best key to the right choice is a study of the rate of cooling or its converse, the rate of heat evolution. The rate at which this heat transfer takes place is given by:

$$Q = UA\Delta T$$

In this equation Q is the total heat transfer in a given time; U is the overall heat-transfer coefficient; A, the area of heat-transfer surface; and ΔT, the logarithmic mean temperature difference.

In the indirect process, area A is limited to the area of the jacket or the pipe coils in the vessel. The temperature difference is determined by the temperature of the refrigerant which is circulated in the system. This difference may be varied by dropping the evaporator temperature to almost any low level. The heat-transfer coefficient is normally the controlling factor in heat transfer, since it is quite low.

Three factors, therefore, govern the quantity of heat which may be removed by circulating refrigerant in coils: (1) the heat-transfer coefficient on the fluid side; (2) the number of pounds of refrigerant that can be circulated through the coils; and (3) the area of the coils. However, there is a practical limitation imposed upon each of these variables as there is upon the temperature difference that can be attained.

For the direct method, using ice as the coolant, the cooling rate is also given by this equation. Here, the heat-transfer area is governed by the surface of the crushed ice. Again, the heat-transfer coefficient is a function of such variables as mixing velocity and viscosity. The temperature difference is fixed by the ice temperature. Quantity of heat removed and final temperature of the solution are easily adjusted by fixing the number of pounds of ice introduced. Due to the large latent heat per pound of ice, cooling capacity can be adjusted economically to even the largest loads.

To illustrate this, consider a chemical process in which 2,000 lb. of crushed ice is known to have been melted in less than one minute. That 2,000 lb. of ice is equivalent to a cooling rate of 288,000 Btu. a minute. In refrigeration terminology, this means a cooling rate of 1,440 tons of refrigeration.

A mechanical refrigerating unit to produce refrigeration at this rate at 32 deg. F. would be an exorbitant investment. Its refrigeration cycle alone would cost well over $100,000. To get a better appreciation of what this enormous capacity means, we must realize that the largest single unit yet built has a capacity of about 5,000 tons of refrigeration.

When a process evolves heat rapidly, removing that heat as fast as it is evolved becomes a difficult job. Doing this cheaply by indirect refrigeration is almost out of the question. While we shall not attempt to illustrate it here, it can be shown that there are times when the rate of heat evolution of a process is so great that it is impossible to remove the heat economically at a rate equal to the rate of evolution by an indirect method of refrigeration.

Indirect cooling is well suited to continuous processes. When the heat generated by a chemical process is relatively constant, the indirect method rates first consideration. Other factors, however, should not be ignored.

Even for intermittent processes, or those in which heat is emitted at varying rates, the indirect method can be applied economically. In such instances, it is possible to store refrigeration in large quantities of very cold brine. Then when the load rises due to an increased rate of heat generation, the stored brine is metered to the coils as required by the process. With such a brine-storage system, we can use a smaller refrigeration unit. And it can be run continuously at a lower and cheaper horsepower level. Brine-storage equipment takes up added space. But often the savings on original investment and the operating savings compensate for this.

A General Rule

Batch processes, on the other hand, give off large quantities of heat at intermittent periods. Thus they call for cooling by direct methods. It must be pointed out, however, that the indirect storage system just described also shows to advantage in batch processes. This is true, but we must remember why batch processes are used: they are used when the continual change from one process to another makes it too expensive to invest in continuous equipment, costly jacketed equipment and insulated permanent piping for refrigerant. We shall, therefore, state a general rule: batch methods call for direct refrigeration.

There is one final reason why direct refrigeration is used. It is used to bypass the problem of corrosion. When corrosion-resistant jackets or coils must be employed, the cost of indirect refrigeration skyrockets. The equipment costs too much. Moreover, the heat-transfer rate is reduced to an impractical level. Clearly, the answer is direct refrigeration.

Ice or water, of course, cannot be used where water is a contaminant. Nor can ice or water be used if temperatures much below 32 deg. F. are sought.

For temperatures below 32 deg. F. it is possible to use eutectic ice. Eutectic ice is made by freezing a solution of salt and water. The resulting ice has a lower freezing point than regular ice. Before the advent of cheap dry ice, eutectic ice and salt mixtures were used to hold ice cream at a low temperature. In 1934 Crosby Field marketed a machine for freezing eutectic sodium-chloride ice in ribbon form.

Comparison of the Two Systems for Producing Ice

CAN ICE SYSTEM. Below are operating data for ice plants of the kind shown above. Ice is frozen in the rectangular cans, then crushed.

10	20	30	40	50	60	80	100	Tons of Ice Per Day
1,679	2,729	3,849	4,728	6,284	7,339	8,648	11,188	Floor Area, Sq. Ft.
Used on All Can Ice Systems								Crusher
24	24	24	32	32	40	40	48	Labor, Man Hr. Per Day†
13.5 cents								Cost Per Cwt.*
1.39 tons								Tons of Refrigeration Per Ton of Ice at 40 Deg. Water
Crushed Ice 38 Percent								Reduction in Cooling Area on Melting ⅓ the Weight of Ice

* Includes power, water, repairs and supplies, labor, taxes and insurance, depreciation and interest on investment for 20 ton system in New York area. Costs may vary for larger plants or other locations, but fragmentary system is always lower.

The ribbons are the same shape and size as Flakice ribbons. Eutectic ice for these ribbons is composed of about 25 percent sodium chloride and 75 percent water. Minimum freezing point obtained with this ribboned eutectic ice is −6 deg. F.; its latent heat of fusion is 101.5 Btu. per lb. On melting, it leaves no solid residue. It takes twice as much of this salt ice to do the same refrigerating job that dry ice does. In 1934, this still gave salt ice a decided price advantage over dry ice. Today, dry ice would be much cheaper. Whether the presence of sodium chloride is an advantage or a disadvantage to the chemical engineer depends upon the process he is working with. In salting-out, he will find it helps; in other processes, it may contaminate reactants.

We have seen, therefore, the reasons for choosing ice as a refrigerant. Ice is used when indirect methods cost too much. It is used when water is not a contaminant. Again, when corrosive material must be handled, the exorbitant cost of jacketed equipment, together with the reduced heat-transfer rate, rule out indirect refrigeration and point to the selection of ice. Where different processes are carried out in the plant, the installation of a permanent indirect cooling unit is uneconomical, so direct cooling with ice is in order. To these reasons must be added another decisive fact: temperature of the solution can be controlled easily with ice—merely by weighing the ice going into a mixture. Indirect methods call for extensive instrumentation, not always a simple matter in a batch process.

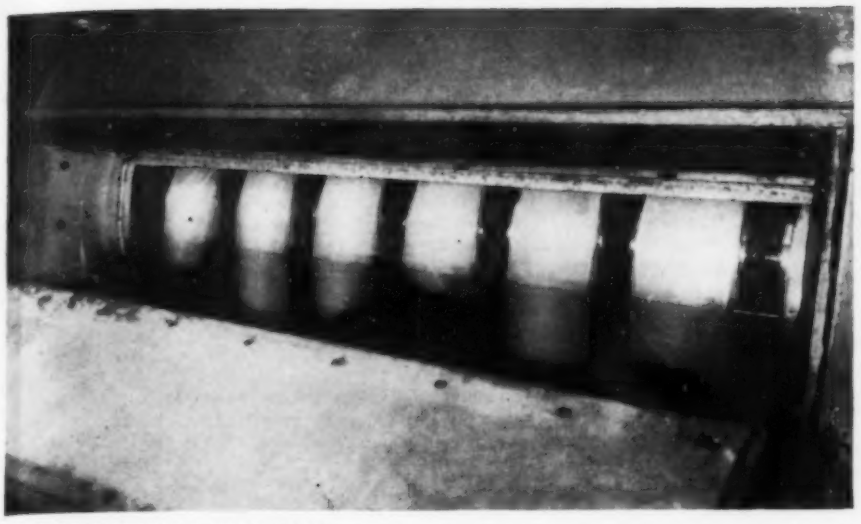
Can or Fragmentary?

Well, suppose you have decided upon direct refrigeration. What is the cheapest way to get your ice? You can buy ice for anywhere from $3.50 to $6.00 a ton and up. How far your plant is from the local ice plant and the delivery conditions at your plant will affect the price. To the cost of ice delivered at the door of your plant, you must add the cost of handling in the plant and the cost of crushing the ice. In crushing, moreover, you incur another loss. If your plant is small, or if you plan to use the refrigeration process only a short time, you will get your ice most economically by buying it from a local ice man. But if your plant is large and it requires ice for its process, it may pay you to make your own ice. The two major industrial methods of making ice are the can-ice and the fragmentary-ice systems.

Can ice, as its name implies, is made by freezing water in a can. The large vertical cans may hold 50, 100, 200, 300 or 400 lb. of water; the usual can holds 300 lb. and is about 50 in. high. These cans are placed close together in a large tank of brine called an ice field. The brine is cooled either in a separate shell-and-tube brine cooler or by passing it over a refrigerated coil housed in the ice-freezing tank itself. An agitator circulates the cold brine that the cans are immersed in.

To insure clear ice, the water in each can is agitated by air fed to the can through a drop tube that extends almost to the bottom of the ice can. If no air agitation is used, a cloudy cake results due to entrapped air. For chemical applications, this would normally be of no consequence.

Ice forms first on the inside surface of the can; as time goes on, the mass solidifies toward its center. The freezing period lasts about 36 hr. Before the cans are removed the drop tube in each can is defrosted and removed; the hole left by the drop tube is filled with water and frozen over. At this point, an overhead crane removes the cans; they are dipped into a tank of



FRAGMENTARY SYSTEMS. Their advantages over can system are evident in data below. Photo shows ribbons of ice peeling from drum of Flakice machine.

	10	20	30	40	50	60	80	100
	402	629	857	1,084	1,312	1,539	1,994	2,449
	None Required							
	1	1	3	3	4	6	8	8
	11.6 cents							
	1.28 tons (Flakice only)							
	Flakice 6 Percent, Pakice 38 Percent							

† Where labor figures are given for can ice systems, such figures include the cost of crushing the ice.

warm water; then they are dumped over on their sides; the blocks of ice slide out of the cans.

For most applications, this 300-lb. block is the finished product. Chemical industry, however, has little use for ice in this form. Before use, therefore, the ice is crushed to insure a larger surface area and easier mixing. Since it is impractical to move large quantities of crushed ice any great distance, the ice is crushed close to where it is used. At least a 10 percent loss is incurred in crushing, due to the fine particles wasted and the work converted into heat. After crushing, the product contains particles varying from the size of an egg to tiny slivers. Final size of the crushed ice, of course, depends somewhat on the crushing machinery. Temperature of the final product is 32 deg. F.

Flakice Machine

First of the two commercial methods for making fragmentary ice in industrial quantities is that patented by Crosby Field. In his method, ice is made by freezing water on the outside of a thin-walled, flexible, metal cylinder that rotates while partly immersed in water. The cylinder in Field's machine is made up of wide, flexible, Monel panels (about 0.02 in. thick) securely bonded to rubber strips. This cylinder is partly immersed in water. The water is contained in a larger cylindrical tank. As it rotates, the flexible Monel-and-rubber cylinder is cooled by calcium-chloride brine sprayed against its inside surface. The stainless-steel spray nozzles are attached to the interior of the brine drum. Before it reaches the freezing cylinder, the brine is cooled in a brine cooler that is remotely located. From the water that the cylinder is partly immersed in, a thin layer of ice is deposited by freezing upon the metal panels of the rotating cylinder. This ice is discharged from the Monel panels as the freezing edge emerges from the water.

The ice is discharged from the cylinder by a unique method. At the discharge point, there is a deflecting roller inside the cylinder. Since the freezing cylinder is flexible, the roller distorts it. But the ice cannot take this distortion. So it leaves the cylinder at a tangent to slide onto a chute where a breaker bar breaks it and it drops into a bin.

From the time that the ice leaves the water surface to the time that it is discharged from the flexible cylinder, the ice is being sub-cooled; it leaves the cylinder at about 22 deg. F. Field's Flakice machine makes thin and slightly curved pieces of dry, brittle ice between 0.10 and 0.14 in. thick. The width of the strips is approximately the width of the metal panels on the flexible cylinder—9½ in. The resultant large surface area per pound of ice produces a cooling rate about six times that of crushed ice.

Pakice Machine

Second of the two fragmentary methods is the Pakice process. The Pakice machine is a stationary jacketed cylinder with rotating cutters. Water is circulated continuously through this cylinder. Expansion of ammonia in the jacket provides the cooling effect. This causes some of the water in the cylinder to freeze, forming a thin film of ice on the inside surface of the cylinder. The ice film is removed by rotating the cutters. Thus very tiny pieces of crushed ice (less than 0.008 in. thick) are removed and discharged from the cylinder with some water. Next, the mixture of water and ice is fed to a briquetting machine. Here, most of the water is eliminated and the ice pressed into the final form in which it is used—a briquette at not less than 32 deg. F.

A plant engineer contemplates an ice-making unit, the ice to be used as a refrigerant in chemical processing. What system of ice manufacture should he choose? It is safe to say that one of the two fragmentary methods is his best bet. Before he decides upon one of the fragmentary systems, he will, of course, with the help of their manufacturers, investigate carefully the comparative merits of the two. But he should forget about the can-ice system.

Our engineer will find that, for service in a chemical plant, a fragmentary-ice system has it all over the can-ice system. Here are the advantages of ice making by a fragmentary method: (1) the installation takes up far less area than the can-ice unit; (2) its first cost is lower, since it fits into a smaller space and requires less building; (3) it needs fewer men to keep it running; (4) its operating and maintenance costs are lower; and (5) cost per ton of ice is much lower.

In summary: as a refrigerant, ice has a place in the chemical industry; its manufacture by the fragmentary systems has advantages over the older method of making it by freezing water in cans; fragmentary methods are not only cheaper but they are better suited to the needs of the chemical industry.

Process Consulting Group

Chairman: R. W. Putnam, consulting engineer
Secretary: H. H. Barnes, asst. manager, Business Service Dept., Los Angeles Chamber of Commerce
Frank Beeson, president, Beeson Bros. Engineering
A. J. Brown, manager, Whiting Corp.
R. S. Clark, manager, Sutorbilt Co.
J. L. Donnelly, manager, James T. Thorpe, Inc.
E. H. Hulse, district engineer, Westinghouse Electric Corp.
Dudley Shrimpton, president, Shrimpton Equipment Co.
J. V. Thomas, president, Natural Gas Equipment Co.
G. L. Warden, consulting mechanical engineer
W. H. Shallenberger, engineer, Marquardt Aircraft Co.
Paul Lindau, engineer, Western Precipitation Corp.

Scientific Committee

Chairman: Dr. R. E. Vivian, dean, College of Engineering, University of Southern California
Secretary: H. H. Barnes, asst. manager, Business Service Dept., Los Angeles Chamber of Commerce
J. A. Beattie, general foreman, Power Dept., Standard Oil Co. of California
Dr. A. O. Beckman, president, National Technical Laboratories
Dr. L. M. K. Boelter, dean, College of Engineers, University of California (L. A.)
Dr. A. B. Burg, head, Dept. of Chemistry, University of Southern California
Dr. R. L. Daugherty, professor of mechanical engineering, California Institute of Technology
L. A. Grunder, chief research engineer, Richfield Oil Co.
Dr. K. J. Leeg, consulting chemist, Baker Oil Tool Co.
Heinz Poppendiek, research engineer, University of California (L. A.)
Homer Reed, chief engineer, Union Oil Co. of California
Harry V. Welch, chief chemical engineer, Western Precipitation Corp.
Dr. F. W. Went, professor of plant physiology, California Institute of Technology
Dr. A. J. Haagen-Smit, professor of bi-organic chemistry, California Institute of Technology

Local scientists lend a hand in . . .

Smog Fighters

John R. Callaham
Pacific Coast Editor, *Chemical Engineering*
San Francisco, Calif.

SCIENTISTS and engineers usually make conscientious community citizens, but their contributions are seldom dominant in efforts to solve community problems of a technical nature. Responsibility for this is often laid squarely on the scientists' doorstep; they are accused of a traditional reticence to become closely affiliated with political or legal forces on a local level. Usually more important is the understandable tendency of the public and reform groups, in their zeal, to lose patience with the typically cautious approach of technical advisors.

Community Welfare

Yet there is a growing realization that science-industry teamwork in cooperation with the public can become a powerful tool toward the betterment of many community conditions. This has recently become particularly evident in the Los Angeles area in respect to the so-called smog problem. Although technique of organization and functioning are still in an evolutionary stage, the advantages are becoming increasingly evident. Results are even now stimulating plans to extend the use of science-industry advisory groups to other technical problems of the community. This story of a method of approach being pioneered in Los Angeles may help other areas to reach the goal of scientific community betterment.

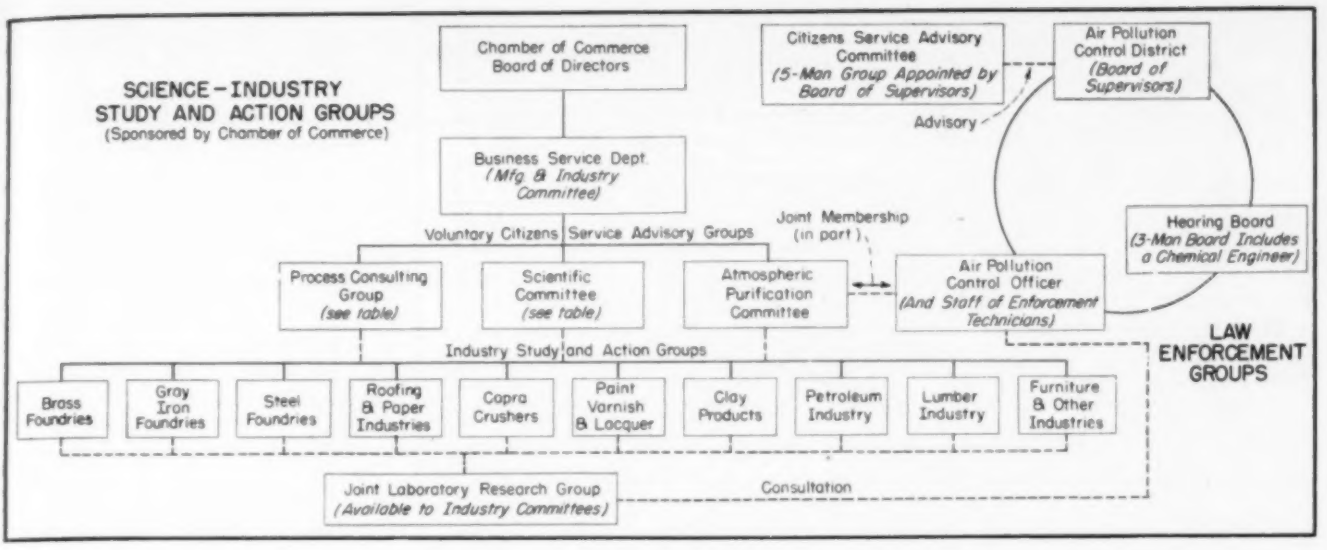
The reality of smog—a nebulous term at best—has been thrust upon Los Angelenos by the almost explosive recent growth of industry, commerce and population; it has been made more obvious by unusual physiographic and meterological conditions. The public has reacted strongly, rightly demands prompt corrective measures. As a result, the Los Angeles County Air Pollution Control District was established by law in 1947 to enforce corrective measures. It consists of a control board composed of the county supervisors, a three-member hearing board which includes a chemical engineer, and an air pollution control officer, now Dr. Louis C. McCabe, formerly in charge of the Army's solid fuels division in Western Europe.

Scientists as Citizens

For many years the Business Service Department of the Los Angeles Chamber of Commerce through its various committees has been active in efforts to reduce atmospheric pollution. As the technical complexities of the problem became more evident, organization of science-industry advisory groups was extended. The present set-up, evolved over a period of almost a decade, now functions through the Manufacturing and Industry Committee (see chart).

Behind these organizational efforts was the realization by an increasing number of sober citizens that strict enforcement of regulatory measures might be difficult: (1) specific causes of the Los Angeles brand of smog were still largely undetermined; (2) standard methods of sampling and analysis had generally not been developed; (3) suggested corrective measures were sometimes far from being technically or economically sound; (4) unless the whole problem could be studied realistically and scientifically, public reform pressure might shift corrective efforts ineffectively from one course to another. Probable results: little over-all good, wasted time and money, considerable harm to scapegoat groups or industries.

The logical approach, it was reasoned, was to enlist on a voluntary basis the most competent local scientific and engineering advice, which would be offered freely to enforcement officials and to suspected offending groups. Success in this objective is clearly shown by the membership lists, for example, of the Scientific and Process Consulting Committees (see tables). These groups have consistently recommended: (1) a policy of sound basic research and engineering advice; (2) full cooperation to help industry help itself; (3) avoiding zealous over-haste that gives only half-solutions.



. . . L. A.'s defense organization against its Public and Industrial Enemy No. 1.

An Object Lesson in Science-Industry Cooperation in the Public Interest

Broadly, here is the present set-up of the science-industry advisory organization (see chart):

(1) The long-standing Atmospheric Purification Committee, headed by George J. Murray, Jr., of Tidewater Associated Oil Co., consists of 44 members representing the chemical process and other industries, insurance, local fire and police departments, air pollution enforcement officers and other groups. It acts in an advisory capacity through the Manufacturing and Industry Committee of the Business Service Department, both to industry and to the pollution authorities

(2) A Scientific Committee, organized early in 1947, advises industry and the community on programs which they feel could be profitably pursued. It has recommended to the air pollution control board that the identity of smog-producing substances be established and that procedures be developed for objective quantitative measurement of them. It functions generally as an expert consulting group to help industry help itself in reducing emission of smoke and fumes. It consists of outstanding local scientists and engineers and is headed by Dean Robert E. Vivian of the college of engineering, University of Southern California (see membership list). As with the other advisory groups, its members serve without compensation as a public service to the community and consider as confidential all information obtained from private sources.

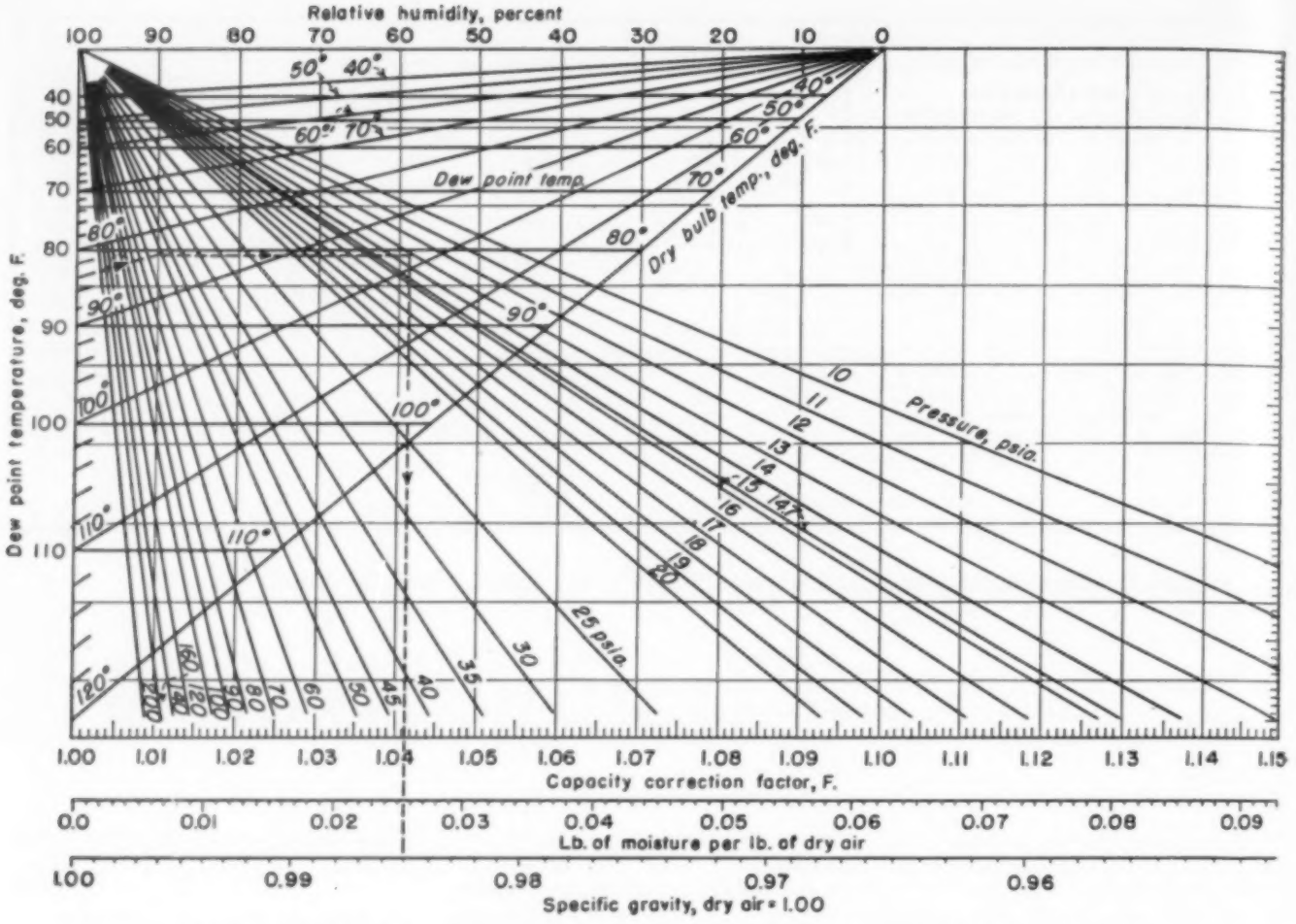
(3) A Process Consulting Group, organized in 1947, helps to develop effective and economical mechanical methods of reducing smoke and fumes, thus supplementing the work of the Scientific Committee. It consists of equipment designers and engineers and is headed by Rufus W. Putnam, consulting engineer (see membership list). Its primary function is to provide guidance to the various industry committees in the development and engineering of equipment.

(4) Industry committees have been formed to study conditions within their own industries. Each of these 13 committees may consult with the Scientific and Process Consulting Groups to determine good practice procedures, techniques to be followed in testing, the interpretation of findings and other related information. Each group disseminates this control information to other members of its industry.

(5) Finally, a Joint Laboratory Research Group was recently organized to contract with industry groups for testing and experimental work. This includes a review of the literature, preliminary sampling, laboratory experiments, and determination of standard methods of procedure, all worked out in close collaboration with the Air Pollution Control Officer. This method expedities the program and avoids extensive and expensive trial-and-error work throughout the industry.

Here is how the set-up is designed to work: an industry committee decides that its members' plants emit material that might contribute to smog formation. It then contracts, through the Joint Laboratory Research Committee, for research work on standard methods of sampling and analysis. This information is passed along to those members of the industry who are participating in the joint endeavor if the industry elects to adopt corrective measures. The Scientific and Process Consulting Committees give expert advice on engineering, equipment design and other technical and economic features of the problem. Through the Atmospheric Purification Committee, local enforcement officials and industrial leaders are informed of the progress and developments. When engineering plans are completed outlining corrective apparatus and processes, they are submitted to the Air Pollution Control Office for a permit. If approval is granted, the installation is then completed. The recommended control methods are then passed along to all members of the industry in the area.

Feature of this science-industry cooperative procedure is that it enables maximum results to be obtained with a minimum of friction, time, effort and money. Its keynotes: competent advice, cooperative action and citizens' service to the community.


Relative humidity, percent
100 90 80 70 60 50 40 30 20 10 0
Dew point temp.
Dry bulb temp., deg. F.
Dew point temperature, deg. F.
Pressure, psia.
25 psia.
Capacity correction factor, F.
1.00 1.01 1.02 1.03 1.04 1.05 1.06 1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15
Lb. of moisture per lb. of dry air
0.0 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09
Specific gravity, dry air = 1.00
1.00 0.99 0.98 0.97 0.96

WITH THIS CHART of corrections and constants for air containing moisture . . .

You Can Simplify Calculations for Humidity and Air Compression

William T. Rice

Application Engineer
Worthington Pump & Machinery Corp.
Harrison, N. J.

APPLICATION of compressed air to manufacturing processes is an important concern to many plant engineers and designers. The limitations that these applications place on the permissible moisture content of the air demand a careful analysis of the compression system. Of no less importance is the consideration of the effect of humidity on the performance of the compressor itself. Simplification of the calculations for moisture content throughout an air compression system is the purpose of this article.

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We here attempt to circumvent the usual method of analysis of humid air employing partial pressures, saturated vapor tables, and the like, by presenting a few constants which can readily be determined from the single chart appearing above. The derivations of these constants and curves have been omitted to maintain simplicity.

To establish completely a condition of air on the accompanying chart, the temperature, pressure, and relative humidity must be known. The quantity most difficult to measure is the relative humidity. If the pressure is substantially close to the standard pressure of 29.92 in. Hg, a psychrometer and psychrometric charts can be used to determine the relative humidity. A much simpler method employing the chart is available if a dew point indicator is used. Horizontal lines on the chart are locuses of constant dew point temperature. Dry bulb temperatures at 100 percent relative humidity are equal to the dew point temperatures. Therefore, a dew point temperature line of, say, 110 deg. F. is drawn horizontally through the intersection of the 110 deg. F. dry bulb temperature line, and 100 percent relative humidity. The intersection of a dew point line with a dry bulb temperature line will indicate the relative humidity. The intersection of a dew point line with a pressure line will completely define the state. When we have thus established the condition of the air, the capacity correction factor, the specific gravity of the moist air, and the pounds of moisture per pound of dry air can be read directly from the chart.

The Chart in Use—an Example

A plant requires 15,000 cfm. of dry air at standard conditions of 60 deg. F. and 14.7 psia., to be compressed to 100 psia. The initial conditions are: relative humidity, 90 percent; inlet pressure, 13 psia.; temperature, 84 deg. F. Air from the aftercooler is saturated at 75 deg. F. and at a pressure of 100 psia.

From the chart (following the dashed lines) for the inlet conditions, D.B. Temp. = 84; R.H. = 90 percent; pressure = 13 psia.; $F = 1.0412$; $w_m = 0.026$; and $S.G. = 0.985$. Similarly, in the aftercooler, D.B. Temp. = W.B. Temp. = 75; pressure = 100; and $w_m = 0.003$.

Then, capacity of dry air at inlet conditions = $15{,}000 \times (14.7/13) \times (544/520) = 17{,}740$ cfm. By Eq. (1), capacity of atmospheric air required = $Q_m = 1.0412 \times 17{,}740 = 18{,}480$ cfm. By Eq. (3), specific volume of moist air = $v_m = (0.37 \times 544)/(0.985 \times 13) = 15.72$ cu. ft. of moist air per pound. By Eq. (4), weight of moist air = $W_m = 18{,}480/15.72 = 1{,}175$ lb. of moist air per min. By Eq. (5), weight of dry air = $W_d = 1{,}175/(1.0412 \times 0.985) = 1{,}145$ lb. of dry air per min. Then, weight of water entering the compressor = $1{,}175 - 1{,}145 = 30$ lb. of water per min., or $W_w = 1{,}145 \times 0.026 = 30$ lb. water per min. Finally, from the initial and final water content of the air, weight of water entering the compressor = 30 lb. per min., as shown; weight of water leaving the aftercooler = $1{,}145 \times 0.003 = 3.44$ lb. per min. and weight of water condensed = $30 - 3.44 = 26.56$ lb. per min.

Equations and Nomenclature

1. $Q_m = FQ_d$
2. $Ha_m = Ha_d/S.G.$
3. $v_m = (0.37 \times T_1)/(S.G. \times P_1)$
4. $W_m = Q_m/v_m$
5. $W_d = Q_d/v_d = W_m/(F \times S.G.)$
7. $W_w = w_m W_d$
6. $AHp = W_m Ha_m/33{,}000 = (Q_m/v_m)Ha_m/33{,}000 = (Q_m/v_d)Ha_d/33{,}000$

Here, Q_m = cu. ft. of moist air; Q_d = cu. ft. of dry air; F = capacity correction factor, from chart; Ha_m = adiabatic head of moist air, feet; Ha_d = adiabatic head of dry air, feet; $S.G.$ = specific gravity (dry air = 1.00); v_m = specific volume of moist air, cu. ft. per lb.; v_d = specific volume of dry air at temperature and pressure of moist air, cu. ft. per lb.; T_1 = temperature of moist air, deg. F. abs.; P_1 = pressure of moist air, psia.; W_m = weight of moisture in moist air flowing, lb. per min.; W_d = weight of dry air flowing, lb. per min.; AHp = adiabatic horsepower; W_w = lb. of water vapor per min.; and w_m = lb. of water vapor per lb. of dry air, from chart.

Many industrial users of compressed air require a definite rate of flow of dry air. The moisture may be condensed before it reaches the process or the water vapor may not take part in it. In any case the capacity of moist air required should be determined for a desired capacity of dry air, or vice versa. For this reason a capacity correction factor F has been shown on the chart. This factor will determine for some stated number of cubic feet per minute of dry air, at a given temperature and pressure, the corresponding number of cubic feet per minute of moist air at the same temperature and pressure, and a stated relative humidity. The situation is expressed mathematically in Equation (1).

This equation clearly indicates the simplicity with which a capacity of moist air can be determined from a given capacity of dry air. It is important to emphasize that both capacities must be measured at the same temperature and pressure.

The specific volume of water vapor at the temperatures and pressures usually encountered in commercial air compression cycles is much greater than that of dry air. It is obvious, therefore, that the specific gravity of the mixture of dry air and water vapor will be decreased somewhat below that of dry air, which is taken as 1.00. The specific gravity of humid air at any specified temperature, pressure, and relative humidity can be read directly from the chart.

The performance of centrifugal compressors is often determined by referring to the adiabatic head developed. This value, similar to the total head of pumps, is a measure of the energy transferred to the gas by the impellers of the compressor.

Computations to determine the adiabatic head required to compress air are usually based on the assumption that the air is dry and at a specific gravity of 1.00. The head required to compress moist air can be simply determined by dividing the head computed for dry air by the specific gravity of the humid air. (See Karassik, Process Engineer's Guide to the Centrifugal Compressor, *Chem. Eng.*, p. 128, Dec. 1947). This is expressed in Equation (2).

Determination of the total weight of moist air is considerably simplified by the use of specific gravity values. Several methods of calculation can be utilized employing the constants herein described. Only the simplest and most straightforward will be developed here.

The specific volume of moist air is equal to the specific volume of dry air, at the temperature and pressure of the moist air, divided by the specific gravity. The relation is given in Equation (3). The weight of moist air per minute is equal to the flow of moist air in cubic feet per min., divided by the specific volume of moist air, as shown in Equation (4). The weight of dry air passing through the system can be computed in two ways, as represented by the two equalities of Equation (5).

Horsepower Requirements

At this point it is interesting to note the effect of water vapor in the atmosphere on the horsepower requirement of compressors. From the derivation shown in Equation (6), it is evident that the adiabatic horsepower can be computed assuming the air entering the compressor is either humid or dry. However, since the weight of moist air and the head required to compress it have already been determined, the most obvious method of solution for adiabatic horsepower is the first expression in Equation (6).

Therefore, the adiabatic horsepower required to compress dry air will be the same as the power required to compress dry air mixed with water vapor at the same volume rate of flow, temperature, and pressure. This process should not be confused with "wet compression" where the air is maintained saturated throughout the compression and there is a reduction in horsepower required. It must be recognized, however, that where water vapor is condensed between steps of compression (as in intercoolers), the mass flow will be reduced by the amount of condensation. The horsepower requirement of compressors following coolers should be determined on the basis of the reduced flow.

The ease with which the amount of moisture condensed can be calculated will now be shown.

The operation of pneumatic tools and equipment requires a minimum amount of water vapor in the air dis-

tribution lines. By the use of the chart presented here, an accurate, simplified method is available for determining the weights of water vapor present in the air at all points in the system, from the inlet of the compressors, through the inter- and aftercoolers, to the receivers.

Moisture Condensed

On the chart, at any state, the weight of water vapor per pound of dry air is indicated. The pounds per minute of dry air passing through the system has been calculated (Eq. 5) and, of course, for all practical purposes remains constant throughout the compression process. The amount of water vapor present at any point in the process can be calculated readily by Equation (7).

If condensation takes place in an inter- or aftercooler, the relative humidity will be 100 percent, that is, the air will be saturated with water vapor. Knowing the pressure and temperature in the cooler and assuming 100 percent relative humidity, the quantity of moisture per pound of dry air can be determined from the chart. By substituting in Equation (7), the maximum weight of water vapor in the air discharged from a cooler can be determined. In most coolers this will be less than the weight of water taken into the compressor and the difference in weights will have been condensed. This calculation performed on the aftercooler will yield the weight of moisture in pounds per minute entering the air distribution lines. An analysis of this sort is as important to those checking existing plants as to designers determining the most economical operating temperature in coolers.

Other Uses

Many additional uses for the humid air chart will become evident upon further study. For those interested in dehumidification of air by compression, the pressure and temperature to which the atmospheric air must be compressed and cooled can readily be determined from this chart for a stipulated final relative humidity. A check on the effectiveness of moisture removal by inter- and aftercooling can be made by calculating the amount of moisture condensed and measuring the flow of condensate from the coolers and receivers.

However, readers should be cautioned that this discussion and the chart pertain strictly to mixtures of air and water vapor, and cannot be extrapolated to other mixtures.

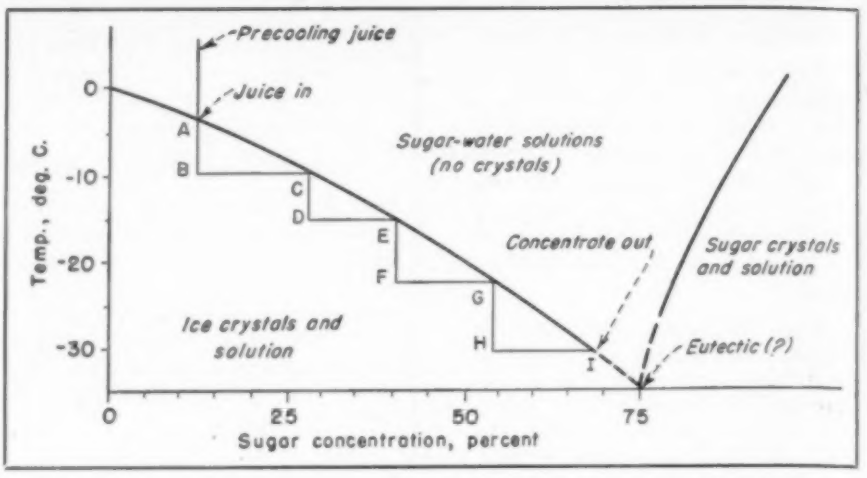


Fig. 1—Phase diagram for sugar-water solutions illustrates a method of concentration to less than eutectic composition by freezing out the water

Freeze Concentration . . .

Progress report on a new process suitable

Theodore R. Olive
Associate Editor, *Chemical Engineering*

A process which may exert a revolutionary effect on the concentration of valuable heat sensitive solutions of many kinds is now approaching the commercial stage in the laboratory of Commonwealth Engineering Co. of Ohio, at Dayton. Developed in the last several months by this concern's technical director, Dr. G. L. Cunningham, the process makes use of new principles in freezing to remove a large part of the water from the original solution, with only negligible loss of the valuable dissolved material. Since concentration takes place at atmospheric pressure and at refrigeration temperatures, there is no tendency toward heat damage, no loss of vitamin content, and no removal of readily volatile aromatics or other constituents contributing to aroma or flavor.

These characteristics indicate a broad field for the process, particularly among food products, including fruit and vegetable juices, coffee, beer, wines, cordials and milk. Less widespread, but still important, uses are possible in the chemical industry where experimental application has pointed to successful preconcentration of blood plasma, serums and antibiotics such as penicillin and streptomycin. The process will probably not compete with multi-stage evaporation on most inorganic salt solutions and other non-heat-sensitive materials, since the operating cost per pound of water removed will inevitably be less for evaporation. However, a novel type of application may develop in the concentration of extremely corrosive solutions since at the low temperatures of operation, corrosion of the equipment and consequent contamination of the product may be so much reduced as to justify the somewhat higher operating cost.

Process Principles

There is nothing new in the idea of concentrating water solutions by freezing. What is new in the Cunningham process is the employment of controlled ice crystal growth in such a way as to effect a clean separation of ice and concentrate, with negligible loss of values in the ice. In the concentration of fruit juices, for example, the ice carries with it only about 1 percent of the sugar initially present, in spite of the fact that nearly 90 percent of the original water is removed as ice.

Procedure in earlier freeze-concentration processes generally has been to freeze the dilute solution to a semi-solid or mushy mass of viscous, concentrated solution and ice crystals, and then to attempt to separate crystals from solution by draining, centrifuging or pressure. A clean separation in such a process is impossible, first because of the high viscosity of the solution, and second because of occlusion of solution in the crystals during their uncontrolled growth.

In contrast, the new process grows

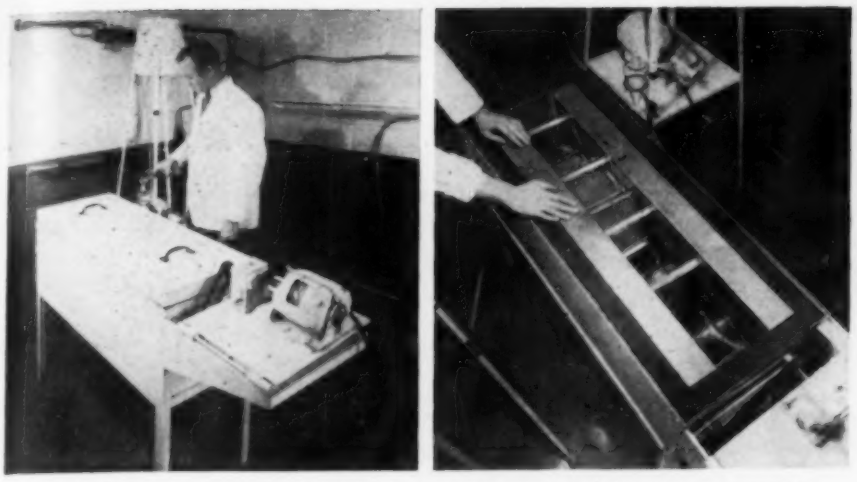


Fig. 2—New Commonwealth pilot plant machine accomplishes the concentration with little loss of solute by counterflow of solution and ice crystals

. . . Becomes Practical

for concentrating heat-sensitive solutions

the ice crystals in several stages and in a countercurrent relation to the flow of solution so that the largest crystals are in contact with the most dilute and least viscous solution and a simple centrifuging is all that is needed to effect nearly complete separation. At no stage does the material being concentrated reach a mushy condition which would make separation difficult.

Apparently the only limitation on the process, aside from the economic one mentioned for non-heat-sensitive materials, is the fact that since it depends on the phase diagram relations of solvent and solute, the concentration cannot be carried quite as far as the eutectic point. This situation is made clear by reference to a phase or freezing point diagram of sugar-water solutions. The sugar is a mixture of invert sugars and sucrose such as occurs in citrus juices. Although the diagram for an actual fruit juice would be somewhat different, it will for all practical purposes illustrate what occurs in orange juice concentration. Such a diagram appears in Fig. 1.

This diagram, which is only approximate, is a plot of sugar concentration against temperature. It shows the boundaries between water-sugar solutions in the liquid condition which exist above the two curves, and the solid phases that separate from the solution at temperatures and concentrations below the curves.

The phase diagram can also be used to explain the operation of the new pilot plant machine just completed by Commonwealth. Shown in Fig. 2, the machine is extremely simple and would appear to involve considerably smaller capital investment than other concentration methods. Basically, it consists of a cascade of four semi-cylindrical metal troughs, each provided with a slowly moving screen which separates the suspended ice crystals from the solution and lifts them into the next higher trough. The troughs are insulated and jacketed, with refrigerated brine in the jackets. Refrigerant — preferably ammonia — evaporates in coils supported in the brine, with refrigerant flow counter to the flow of liquid being concentrated. Baffles between the various sections of the brine jacket prevent brine circulation and maintain the desired temperature differentials among the several troughs.

Because the greater part of the experimental work has thus far been done on orange juice, the operation of the machine will be described for this product. Fresh juice at room temperature, containing about 12½ percent solids, is cooled initially to A on Fig. 1, at about −3 deg. C., by heat exchange with the ice leaving the process. The cold water produced in melting the ice can then be used in condensing the refrigerant, thus contributing high refrigerating efficiency.

The pre-cooled juice enters the highest trough at A where it is supercooled to B at about −10 deg. C. Actually, ice begins to form almost immediately as the cooling takes place so that the concentration increases along some intermediate path to C during the cooling. At this temperature and concentration the solution overflows to the second trough where further cooling to D and concentration to E takes place. From the second trough the solution overflows in turn to the third and fourth troughs where the temperature is further reduced and the concentration increased in turn to F and G and then to H and I. Finally, the solution overflows the fourth trough at about 68 percent solids and at a temperature of about −30 deg. C. At this concentration the product may be frozen or kept refrigerated for shipment, although this is unnecessary since the sugar content is high enough to be self-preserving.

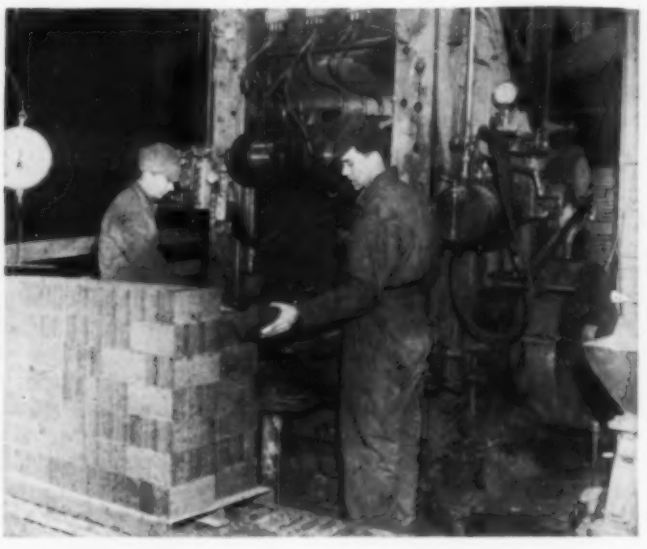
Although the formation of ice has been mentioned, it has not been explained exactly how this crucial feature of the process takes place. The moving screens in each trough prevent any but the smallest ice crystals from moving forward with the juice and instead convey the crystals backward against the flow of solution. In the lowest and coolest trough (No. 4) there is undoubtedly some spontaneous formation of ice crystal nuclei and it is probable also that nuclei from the higher troughs may enter with the solution. At any event, these nuclei begin to grow in the most concentrated solution, reaching a size where they are caught by the screen and elevated to trough No. 3. In this trough they grow more rapidly in less concentrated solution and then are conveyed in turn to trough Nos. 2 and 1. Thus the crystals grow under increasingly favorable conditions of temperature and concentration until they discharge to the centrifuge from trough No. 1, while the solution becomes progressively more concentrated in contact with smaller and smaller crystals until it discharges as the finished product from trough No. 4. Both conditions, it is to be noted, are favorable for maximum separation and minimum occlusion. An incidental advantage of the method is the recovery of sensible refrigeration from the colder ice crystals as they are returned from each trough to the next higher and warmer trough.

This progress report has given only a general idea of the capabilities of the new process. As further work is completed, and as licenses are awarded and commercial installations are made, more information will become available and the sphere of usefulness will be further delineated. Meanwhile, the possibilities are impressive and suggest the need for consideration in relation to a variety of heat-sensitive products now being treated by other methods.

1. Storage. Coarse-ground raw materials are transferred by scoop truck from compartments in the storage building.

2. Fine Grinding. Fine grinding is the function of these dry pans, supplemented by ball mills for added fines.

4. Batching. This lorry car, with its own dust collector, assembles weighed batches and discharges by belt to mixers.

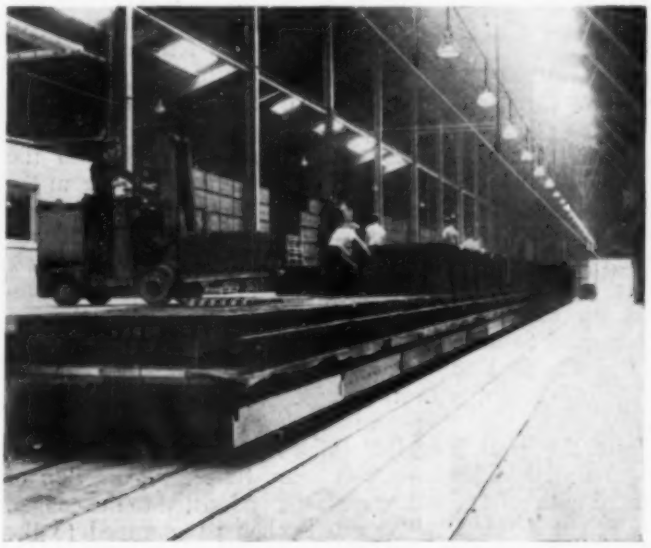


5. Pressing. Heavy duty presses are used to form both the chemically bonded refractories and those to be burned.

7. Firing. Burning temperatures as high as 2,800-3,000 deg. F. are developed in this Swindell-Dressler tunnel kiln. It has a length of 324 ft., a cross section of 8 x 9 ft., and a capacity of 32 cars. Good design makes the under-car temperatures low.

3. Screening. Electrically vibrated triple screening units provide four size fractions later stored separately.

6. Drying. Last processing step for chemically bonded brick is drying in air dryers providing positive circulation.



8. Inspection. Burned brick are withdrawn from the kiln, cooled and then inspected and unloaded from kiln cars.

New Plant Makes Basic Refractories

Quality control, streamlined handling and plant housekeeping are important features

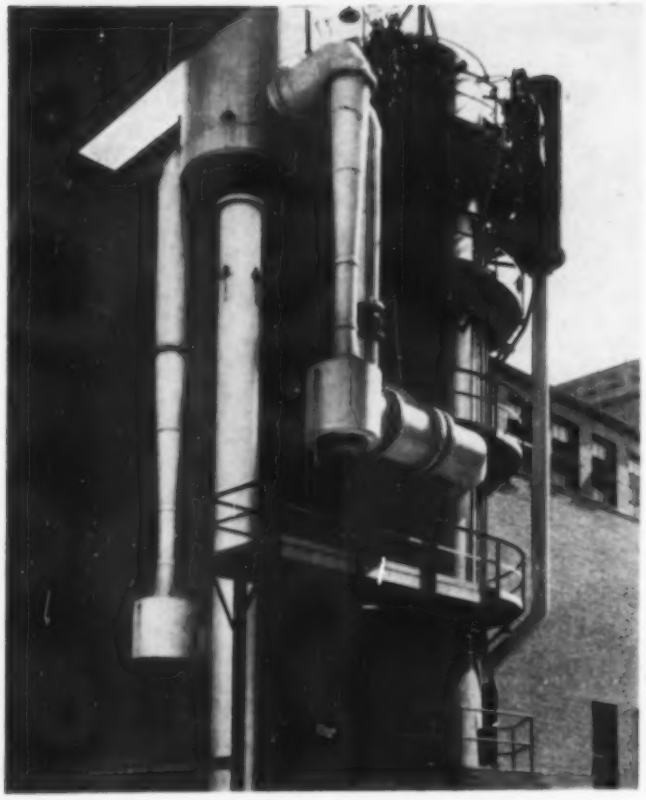
Basic refractories, including both burned and chemically bonded types from chrome ore and magnesite and their combinations, as well as from olivine (for making forsterite refractories), are now being produced in a new plant at Baltimore by the Harbison-Walker Refractories Co., of Pittsburgh. The 24th plant of this concern for refractories of all types, it is the third for basic refractories manufacture and adds greatly to the capacity for basic types.

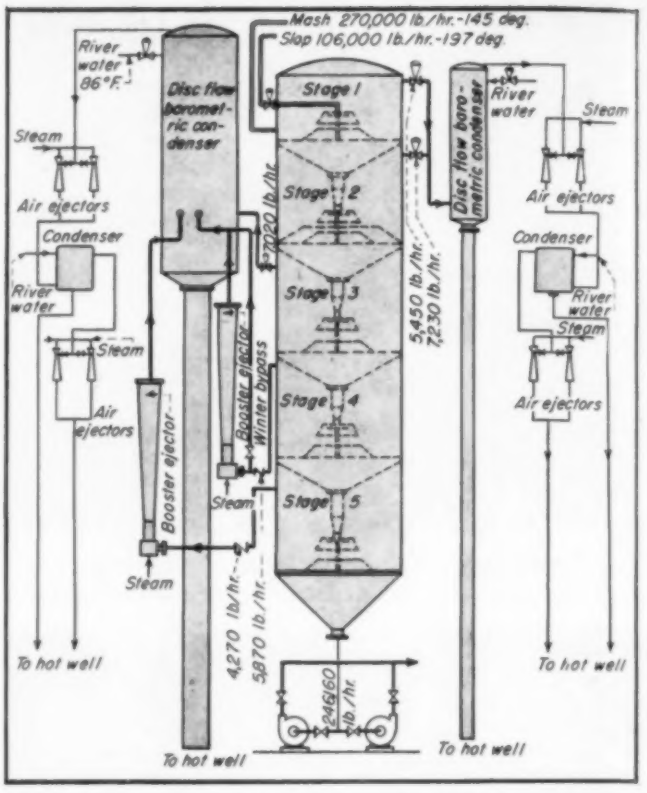
Incorporating all the experience gained in the company's earlier plants, the new plant has many novel features designed to improve quality, reduce handling, avoid contamination and particle size segregation, and aid plant housekeeping. Particular attention is paid to attaining the optimum distribution of particle sizes in all mixes and much study has been devoted to this matter.

The three raw materials arrive at the plant in hopper bottom rail cars and are unloaded to a track hopper by a vibrating car shake-out. Passing over an apron feeder and grizzly, the materials enter a gyratory for coarse crushing and are elevated to the secondary cone crusher by belt. A second belt elevates to a third in the roof peak of the storage building where a shuttle conveyor discharges the material to any of the 30 individual compartments. Ore is reclaimed by electric scoop trucks and carried either to one of two oil-fired rotary dryers, if wet, or to the belt which elevates the dryer discharge, if drying is not needed. These belts elevate to dry material storage hoppers which feed the fine grinding equipment.

To prevent contamination, separate equipment is used for the three raw materials from this point to the batch mixers. This means three dry pans, three ball mills, three sets of triple screens and a total of 110 bins for the various kinds and sizes of materials. Fine grinding is accomplished in dry pans with ¼-in. discharge openings, supplemented by ball mills to provide an adequate proportion of fines. Both electric and electronic grinding controls are used. By means of triple electric vibrating screens the ground product is sized into four fractions of proper size and the fractions stored in individual bins. Batches are made up to exact weight specifications by a travelling larry car having its own dust collection system, which discharges to belts feeding the mixing pans where water and the necessary bonding agents are added.

From the pans the nearly dry mix drops to the feed hoppers of the brick presses where, under pressures of 5,000 to 10,000 psi., the brick are formed. The brick are immediately loaded either onto pallets in the case of the chemically bonded brick, or onto kiln cars if the brick are to be burned. After drying in a dryer receiving waste heat from the kiln, the chemically bonded brick are ready for inspection, storage, and shipment. Brick to be burned pass through their own dryer on the kiln cars and then enter the 324-ft. oil-fired Swindell-Dressler tunnel kiln where they are burned at temperatures as high as 3,000 deg. F.





Outside view, above, of new unit in which mash and slop are cooled in five successive stages as they descend from top to bottom of central cylindrical shell evaporator. Diagrammed above are operations of the evaporator and its equipment.

Multi-Stage Evaporative Cooler

Although multi-stage evaporative cooling has been used in air conditioning systems, Hiram Walker is the first to use a unit of its kind on a process material.

Charles H. Rodgers
Hiram Walker & Sons, Inc.
Peoria, Ill.

When the Hiram Walker distillery was built in Peoria, the supply of underground cooling water was more than adequate for all plant requirements. Subsequent industrial growth of the city and increased use of air conditioning systems have since reduced the underground water supply to such a point that it has become necessary to use water from the adjacent Illinois River for as much of the cooling operations as possible. During winter months the river temperature is frequently as low as 32 deg. F. making possible its use in double pipe coolers. In summer, however, the river temperature goes up to 85 deg. F., or even higher for short periods. It has become necessary, therefore, to resort to a supplemental type of heat removal in order to cool distillery mash to the necessary 75 deg. F. after cooking the grain, so that fermentation can begin at the proper temperature for the yeasts that are used. Evaporative cooling was chosen for this purpose. The process for making alcohol is briefly described.

The distillery produces whiskey, neutral spirits, and, during the war, industrial alcohol (denatured neutral spirits). Grain is usually received whole and is unloaded direct from cars and transported to the plant grain storage elevator by pneumatic conveyor systems. It is weighed on automatic scales, scalped, and conveyed to bins. These bins provide a gravity feed to 12 three-high roller mills where the grain is reduced to meal.

A small percentage of the meal is used to prepare the yeast mash. This yeast mash is first stocked with a lactic acid culture. After sufficient development of lactic acid it is sterilized and then stocked with a selected yeast strain from a pure culture yeast machine. The yeast growth and attenuation are controlled by temperature regulation so as to be ready at scheduled time for yeasting a fermenter.

The main mash may be either pressure cooked or atmospheric cooked. For pressure cooking, water at about 120 deg. F. is first taken into the cooker. Meal is then weighed from the meal bin, through an automatic scale, and stirred into the cooker. It is cooked with live steam to 280 deg. F., for a given period, and the pressure then reduced to atmospheric by blowing off the excess steam. Pressure is further reduced by use of barometric condensers and jet exhausters until the temperature is down to about 150 deg. F. Malt which has been pre-slurried and has had some time for extraction of diastase is then admitted to the cooker. The mixed charge is dumped to the drop tub where conversion of starch to sugar proceeds.

Atmospheric cooking varies from the

above by stirring both the malt slurry and meal into the water at the beginning of the operation. The heating takes place in several stages of heating and holding. The final heating and holding step is at 154 deg. F. The mash is then both cooked and converted and is ready to be dumped to the drop tub.

From the drop tubs the mash is pumped through mash coolers where it is cooled to 75 deg. F. and delivered to a fermenter. Screened backslop (recycled still bottoms), fresh from the stills is pumped to the same mash cooler and mixed with the mash on its way to the fermenter. Details of the evaporative cooling system will be explained in detail in later paragraphs.

Fermentation period is three days. Fermenters contain about 7 percent alcohol by volume when ready for distillation.

Whiskey is distilled from a single column beer still. The operation consists of a stripping of alcohol in the lower exhausting plates and a control of proof by the quantity refluxed to the upper wine plates. Undersirable products of the fermentation side reactions are removed by addition of a "wash plate" above the top wine plate in the beer still. Fresh water is fed onto this plate to scrub the vapors rising from the top wine plate. The discharge from the wash plates is returned to the still in the lower exhausting section, on the fourth plate below the beer feed. This delivers the small percentage of high-boiling water solubles, which have undesirable flavor in beverage products, far enough down the still to prevent them from again appearing in the distillate.

Distillation of neutral spirits is done in a conventional four column spirit unit consisting of beer, aldehyde, oil, and rectifying columns. A portion of the screened non-alcoholic residue (slop) is returned to the mash cooler to be cooled and used to back-slop the fermenters being set. This assists in pH control and water economy, and offers a number of other operating advantages. Most of the slop, however, is pumped to the dryer house for complete recovery of dried feeds. (This byproduct recovery was described in a *Chem. & Met.* Pictured Flowsheet in June 1945, pp. 130-133.)

Cooler Operation

When supplies of cooling water were found inadequate, it was decided to build a vacuum evaporative cooler, consisting of five stages of cooling. The first stage was designed to cool slop from 195 deg. F. to 145 deg. F. and allow it to be mixed with the incoming mash at 145 deg. F. The following four stages were each designed to further reduce the temperature of the mixture until the discharge from the fifth stage was at 75 deg. F.

The temperature of each stage is controlled by maintaining the absolute pressure corresponding to the desired temperature. In the vapor line from every stage is an automatically controlled butterfly valve which allows just enough vapor to pass to maintain the desired absolute pressure.

Each hour this unit cools 106,000 lb. of slop at 197 deg. F. and 270,000 lb. of mash at 145 deg. F. to 75 deg. F. Steam requirements, supplied at 220 psi., are 7,600 lb. per hr. in summer. Water requirements are reduced, as the temperature of the river drops, from a summer peak of 4,700 gpm. to about 2,000 gpm. in winter.

Characteristics of steam jets are such that no throttling can be tolerated. As long as any jet is in operation it requires its full steam capacity and the throttling must all be done by the control of the vapor suction to the jet. The fifth stage winter jets require 1,560 lb. per hr. of steam and this is used at all river water temperatures below 65 deg. F. At 32 deg. F. river temperature this booster could be eliminated but the more sensitive control attained by its use justifies the small steam requirements.

Fifth stage summer jets require 3,560 lb. per hr. of steam and these jets are used when the river temperature reaches 65 deg. F. The steam demand is then constant for all river temperatures up to the maximum (around 86 deg. F.).

The fourth stage booster requires 3,280 lb. per hr. of steam for operation at all river temperatures above 65 deg. F. and is bypassed at all temperatures below 65 deg. F. A total of 760 lb. per hr. of steam is used throughout the year to operate the two sets of holding jets.

The new mash cooler was erected beside the fermenting rooms. It is the first multi-stage vacuum cooler to be used for cooling mash or slop. A few small single-stage vacuum coolers have been previously used for cooling mash, and multi-stage jobs have been used to cool water for air conditioning. But this is the first unit of its kind to be used in this manner.

This cooling unit consists of an evaporator body divided into five stages, with two booster ejectors, two barometric condensers (each equipped with two pairs of air ejectors) and all necessary control instruments and automatic valves. Ingersoll-Rand supplied the ejectors, condensers, and pumps, based on a pilot plant and their own original design. Guardite Corp. built the evaporator, supplied the controls and other accessory equipment needed, and erected the entire unit.

Procedure

The slop is metered into Stage I at 197 deg. F. This first stage is maintained at a vacuum of about 23.5 in., corresponding to a temperature of 145 deg. F. To maintain this vacuum, the air is expelled from the smaller of the two condensers by means of air ejectors. The condenser is thus under a vacuum corresponding to the temperature of the condenser water. This vacuum pulls vapors through the vapor line from the first stage, cooling by evaporation the material flowing through this stage. The control instrument, actuated by temperature changes and set to maintain the desired 23.5 in. of vacuum, throttles the control valve in the vapor line to allow the quantity of vapors to pass for maintaining the desired cooling effect.

Mash at 145 deg. F. is admitted to Stage I through a meter and there mixed with the slop that has been cooled to 145 deg. F. This mixture passes to Stage II where the vacuum is increased to produce a lower temperature. Vapors are pulled from this stage by the same condenser, but the quantity of vaporization is controlled by another instrument and separate automatic valve.

Stage III operates at a further increase in vacuum, and corresponding decrease in temperature. The quantity of vaporization again is controlled by another automatic valve. The vapors pass to the larger condenser.

At Stage IV the temperature is reduced nearly to summer temperature of the river water. Under these summer conditions the vacuum in the condenser is not sufficient to pull vapors from the fourth stage. A booster ejector is here used to pull the vapors from this stage and push them into the condenser. This booster creates suction by a jet of steam at 220 lb. pressure. In winter the river water is cold enough to allow bypassing this booster. The vaporization from this stage is controlled by an automatic valve the same as in the previous stages.

Stage V operates at a further decreased temperature and increased vacuum to discharge a mash and slop mixture at 75 deg. F. For optimum results it requires the use of its booster during the entire year, but less steam is used in winter. It is controlled the same as the previous stages.

The cooled material leaving the last stage is pumped directly to the fermenters.

New Xylidine Process Revealed

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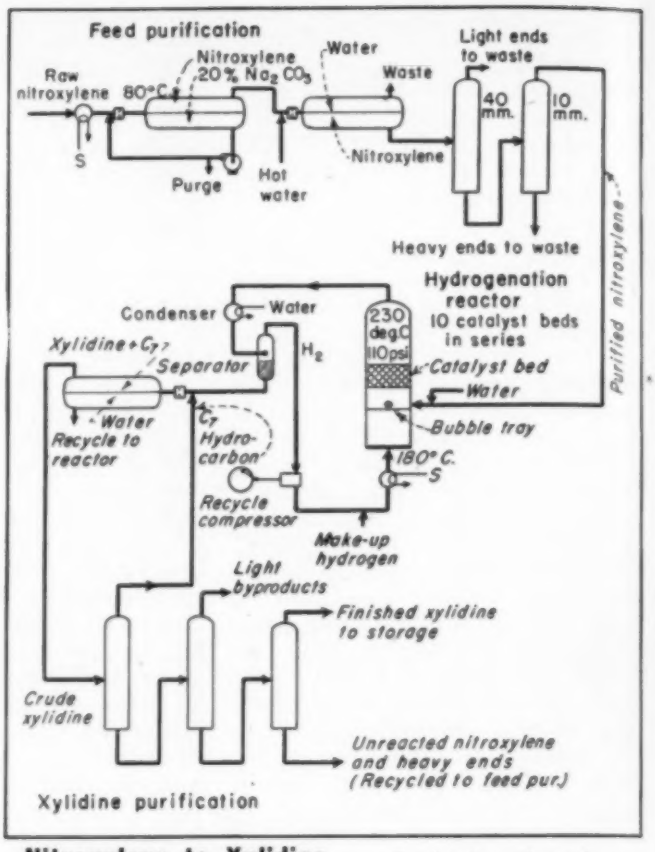


Nitroxylene to Xylidine Crude nitroxylene, from nitration of xylene, is purified and hydrogenated to xylidine.

Xylidines have been made by batch methods for years. This continuous catalytic hydro-

IN 1943 there developed a tremendous demand for 100-octane gasoline which could not be satisfied by existing petroleum refinery facilities. Many new 100-octane plants were under construction but these could not alleviate the critical shortage which thousands of new planes had created; the shortage was daily becoming more serious.

Shortly before that time, the motor research laboratories of Shell Development Co. discovered the outstanding value of amino-aromatics in gasoline blends under the rich-mixture conditions used in take-off and combat operations. Although these had been known to have anti-knock characteristics in automotive-type engines, their effectiveness under the special conditions in high-output aircraft engines proved to be many times as great.

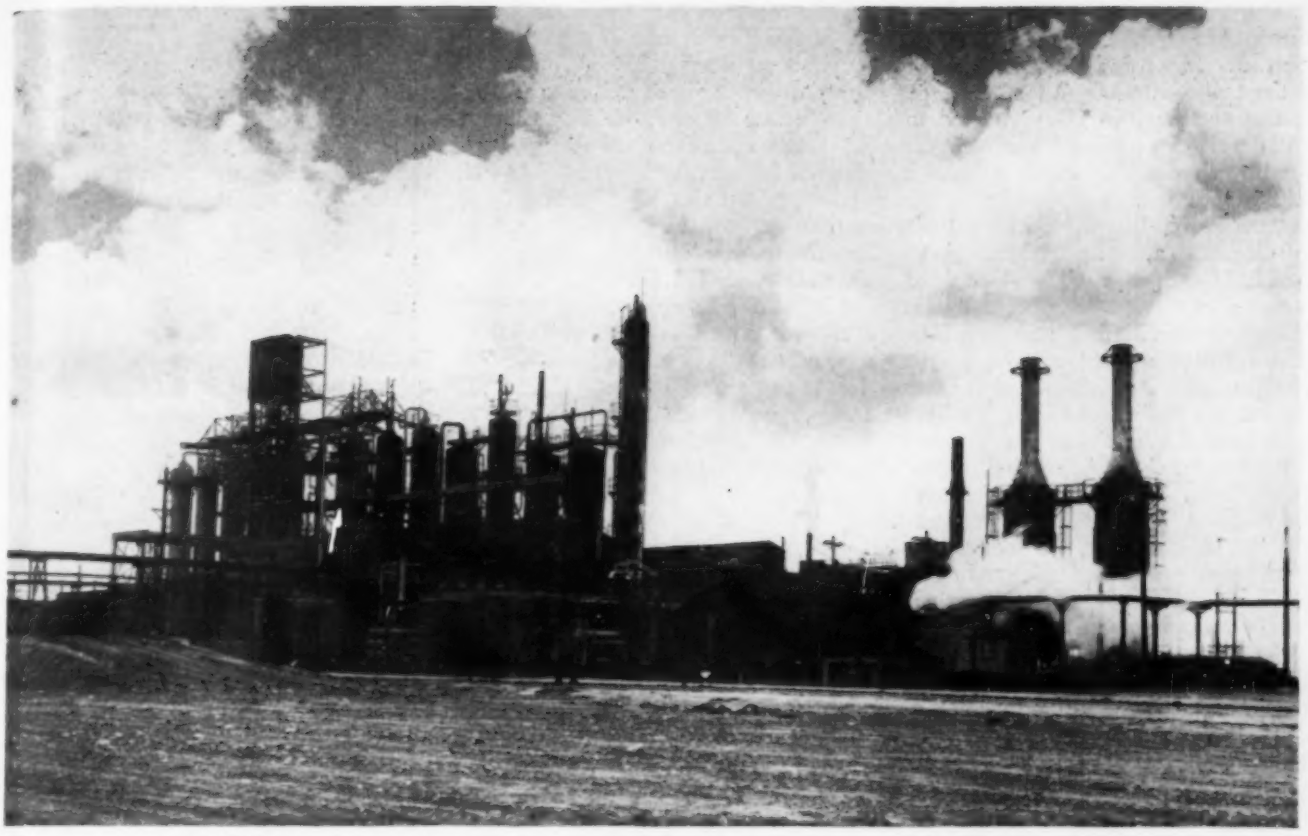
Of these compounds, xylidine was outstanding from many practical angles: anti-knock performance, stability, low freezing point, solubility, feasibility of manufacture, availability of raw materials. It offered the possibility of markedly increasing the output of high-performance fuel, since each volume of xylidine is equivalent under high-output conditions to 10 or more volumes of cumene or 20-30 volumes of high-quality alkylate. Or xylidine could lift a regular 100-octane blend into a super-grade if made necessary by combat requirements. Its addition did not involve the severe engine maintenance problems caused by the high dosages of tetraethyl lead necessary for either of these purposes.

Birth of Charlie Sugar

When Shell informed the War Department of this discovery, confirmatory tests were made by the Army; at once there was strong interest in producing xylidine in large amounts. But adding a large construction project for the process originally proposed by Shell to our 100-octane and rubber programs was obviously impossible. At the Army's suggestion, Shell searched for a combination of new process and existing plant which would permit early production with a minimum of new equipment. The answer: Cactus Ordnance Works, a new ammonia plant in the Texas Panhandle, which had been 80 percent completed and then stopped. The Government authorized Shell Chemical to convert Cactus to xylidine production and complete the necessary facilities. The project was classified as restricted; until the War Department's present release, it was known only as the "CS Program" as a convenient code for "cumene substitute." In official Army wires, xylidine was "Charlie Sugar."

Weeks before formalities were completed, Shell started work on a commercial process for manufacture of xylidine adaptable to available equipment. Since excess TNT plant capacity was available, why not work with xylenes obtainable from petroleum? These could be nitrated similarly to toluene and the resulting nitroxylenes hydrogenated to the amine. Hydrogen facilities of the Cactus ammonia plant answered the difficult question of large-scale hydrogen supply. Shell Development's Emeryville laboratory found both liquid and vapor phase hydrogenation catalysts that showed promise.

Thus research, pilot plant operation, full scale design, plant construction, and building of an operating staff proceeded simultaneously and at top speed. Process designers worked with skeletal data and were forced to design around equipment already on the scene. Storage vessels were tipped on end to become distilling columns. Bubble-trays were made to serve as



Ammonia to Xylidine Cactus Ordnance Works, above, was built as an ammonia plant. Shell's conversion to xylidine took some fancy dodging of wartime materials shortages. Example: Distilling columns made from up-ended storage tanks.

genation method, used by Shell during the war, has many process and engineering innovations

heat exchangers. A cracking furnace became a catalyst plant. The toxic and explosive properties of nitro-aromatics had to be reckoned with.

In addition to Shell, organizations which contributed to the success of this emergency project were the U. S. Ordnance Department, U. S. Corps of Engineers, Chemical Construction Co. and Brown and Root. More than 3,000 people participated directly.

The first plant units—those for purifying hydrogen and nitroxylene—began operating in December, 1943. The first carload of finished product was shipped early in February 1944, only nine months after the War Department approved the scheme.

Xylenes (90 to 95 percent pure) from Baytown Ordnance Works were shipped for nitration to three TNT plants in the South; the crude nitroxylene mixture was thence shipped to Cactus. Before the raw material could be distilled, it was necessary to remove the nitrophenolic byproducts which constituted explosive hazards. This was done by treating with hot 20 percent soda ash solution in a mixer-settler system. Organic sodium salts, also believed to be thermally unstable, were reduced to less than 0.001 percent by a hot water wash. Severe emulsion problems in this step were largely overcome by careful adjustment of mixing severity. The treating capacity was about 5,000 bbl. per day.

Treated nitroxylene still contained 5-7 percent light hydrocarbons and 2-3 percent dinitroxylenes. To protect the hydrogenation catalyst from these and other more obscure compounds which would poison the catalyst, top and bottom cuts were taken off the nitroxylene in 18- and 6-tray columns. Operating pressures as low as 10 mm. Hg were maintained to hold temperatures down because of the potential explosiveness of the dinitro-compounds. As further precautions, the concentration of dinitroxylene in the bottoms was limited to 30 percent; reboiler temperatures were limited to 155 deg. C.

The hydrogen plant, of standard design by Chemical Construction Co., required few alterations. Natural gas from nearby fields was mixed with superheated steam and cracked over a suported nickel catalyst at 700 deg. C., producing a crude gas with 7-11 percent CO and 8-12 percent CO_2 (excluding steam). Addition of saturated steam then lowered the temperature to 500 deg. C. and passage over an iron oxide catalyst reduced the CO to about 3 percent. The CO_2 was largely removed by water scrubbing at 240 psi. Further scrubbing with copper ammonium formate solution at 1,700 psi. completed the purification. Gas sent to the catalytic hydrogenation reactors analyzed about 96.5 percent H_2, 2.6 percent N_2, 0.8 percent CH_4 and 0.001 percent each of CO and CO_2.

Novel Reactor

Hydrogenation of one mole of nitroxylene theoretically requires three moles of H_2 and releases almost as much heat as burning the same amount of H_2. Every pound of nitroxylene reduced liberates 1,370 Btu. Since the reaction must be held within fairly narrow temperature limits to avoid over-hydrogenation, the tremendous exothermic heat must be removed. Although plenty of tubular exchangers were at Cactus, none was suitable for packing with catalyst to make an isothermal reactor. A novel and ingenious alternate was worked out by the design engineers.

Four scrubbing tower shells, 8 ft. diameter by 72 ft. high, were converted into 10-bed catalytic reactors.

in. deep, was preceded (up-flow) by a conventional bubble tray. On the first (bottom) tray was fed about a tenth of the liquid nitroxylene feed. A large circulating stream of H_2, preheated to 200 deg. C., vaporized the feed off this first tray and carried it up to the first catalyst bed. The hydrogenation reaction heated the whole stream from 180 deg. C. (after feed vaporization) to 220-230 deg. C. The combined stream, now containing some xylidine, entered another bubble tray on which more nitroxylene was fed, along with enough liquid water to adjust the gas temperature again to 180 deg. C. The increment of nitroxylene was reacted in the second catalyst bed—and so on up the tower through ten sets of trays and catalyst beds. The exit stream, rich in crude xylidine, was condensed in ordinary water-cooled exchangers, the large excess of H_2 was recycled. System pressure was about 110 psi.

The hydrogenation reactor product was condensed in conventional water-cooled tube bundles, totalling 30,000 sq. ft. It contained various isomers of xylidine, unreacted nitroxylene, byproducts, and a large amount of water. After separating the hydrogen, the liquid phase was mixed with a little C_7 hydrocarbon to facilitate the ensuing separation of two liquid phases. The aqueous phase was largely recycled to the catalytic reactors; it contained appreciable byproduct ammonia. Composition of the organic phase (excluding diluent C_7) was about:

	Percent
Xylidines (weight)	84
Nitroxylenes	2
Byproducts	4-8
Water (dissolved)	Balance

This crude product was stored for purification by distillation.

In actual operation it required considerable experience to develop the technique of balancing the many liquid flows to match the temperature rises, especially when some of the catalyst beds began to decline in activity. Nitroxylene which escaped hydrogeneration in one bed then added to the temperature rise of succeeding beds. It was also necessary to introduce a set of vapor mixing baffles between each bubble tray and its catalyst bed. Otherwise, the nitroxylene concentration across the 8 ft. diameter varied sufficiently to cause 100-deg. C. variations within a single bed.

Catalyst Conditions

Catalyst used for the hydrogenation was nickel (or Ni-Cu) on an inert carrier, in the form of ¼ in. to ⅜ in. diameter pellets. Conversion of Cactus to CS manufacture included the building of a complete catalyst plant. Useful life of the catalyst was in the order of 70 volumes of xylidine per volume of catalyst, and it operated at a liquid hourly space velocity (based on volume of liquid nitroxylene feed) of 0.15-0.20. Catalyst failure may have been due to poisoning, but the 5-7 percent carbon accumulated on the catalyst was probably responsible in itself. In most cases the catalyst failed by losing activity, but in a few cases excessive pressure drop was actually limiting. Catalyst was reactivated *in situ* by passing hot steam (up to 450 deg. C.), with gradually increased oxygen content, through the reactor beds. Since each reactor held 27 tons of catalyst, extension of catalyst life to a maximum was of great interest.

It was found that catalyst life could be extended by careful balancing of operating conditions. Vapor temperature entering each catalyst bed was the most important single variable. Too low a temperature permitted liquid nitroxylene to deposit on the catalyst, killing it prematurely. Low temperatures also reduced over-all catalyst life. Too high a vapor temperature increased byproduct formation and thus cut yields. At the start of the run with fresh catalyst, byproduct formation was as high as 50 percent for a few hours. However, it quickly fell to 10 percent and then gradually to 3 percent. When catalyst activity began to decline markedly, it was possible to extend its life 20-30 percent by increasing vapor temperatures; byproduct increase was slight.

Xylidine Purification

Crude product was refined in a series of three distilling columns. The first, an 8-ft. by 20-tray column, ran at about 350 mm. Hg top pressure and a 0.37 R/F ratio. It removed the diluent C_7 hydrocarbon, previously introduced for phase separation, as a top cut. This was then recycled to the process.

The second column was 6 ft. by 32 trays and operated at about 400 mm. Hg pressure and an internal R/F of about 1.0. This column removed the light byproducts, principally dimethylcyclohexylamine, which boiled fairly close to xylidine. Other light byproducts were the alcohol and hydrocarbon corresponding to this amine.

A third column, 9 ft. diameter by 24 trays, operated at about 200 mm. Hg top pressure and R/F of 1-2. Finished product was taken off the top; heavy ends were recycled to the nitroxylene feed columns for recovery of unconverted feed. Because of the rather close separations to be made from both light and heavy impurities, operation of the finishing columns was a constant balance of capacity against yield. Pressure drops also had their indirect effects since high bottom temperatures promoted heavy end formation and coking of reboiler tubes.

Finished CS contained over 99 percent xylidines plus 0.5 percent nitroxylene and traces of byproducts. It was a remarkably pure chemical, compared to most high-octane additives and considering the scale of operation; it conformed to rigid government specifications as to physical properties and anti-knock value. All finished product was inhibited with 0.01 percent of an alkylated phenol to prevent discoloration or gum formation; it was stored under a N_2 atmosphere.

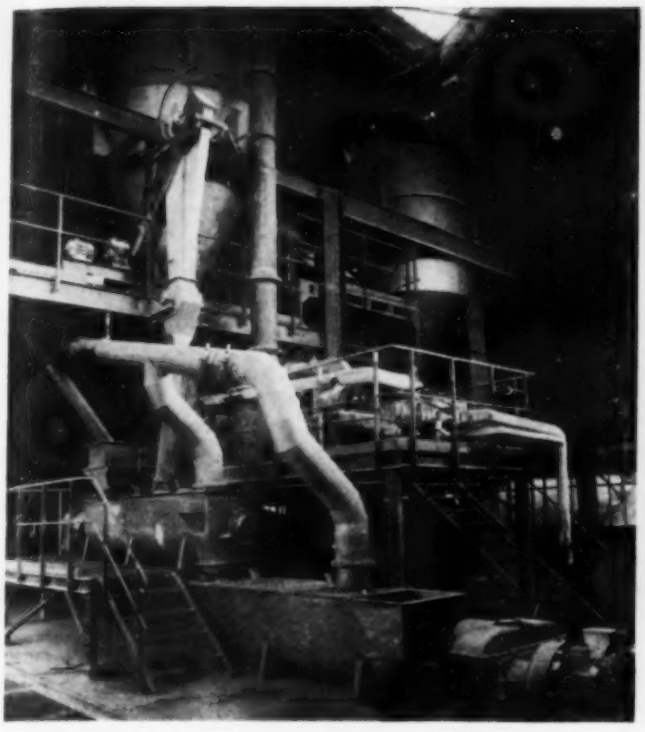
Selection of materials of construction was exceptionally easy; there were really no problems at all. Ordinary carbon steel was used throughout in processing equipment, with a few exceptions caused by wartime conditions rather than by corrosion requirements. In the reactor circulating system, copper-containing alloys were avoided because of ammonia formed as a reaction side product. Here again, ordinary carbon steel was satisfactory.

Since Cactus was located 60 miles from a city, it had to provide a complete community for all personnel. The reservation included 18 square miles, complete with housing projects, entertainment facilities, stores, power generating plant, hospital, and sewage disposal system. During the period of construction and plant start-up, it was necessary to dispense with many refinements—such as permanent roads and sidewalks—and personnel was exposed to a combination of mud, dust-storms, blizzards and bare prairie.

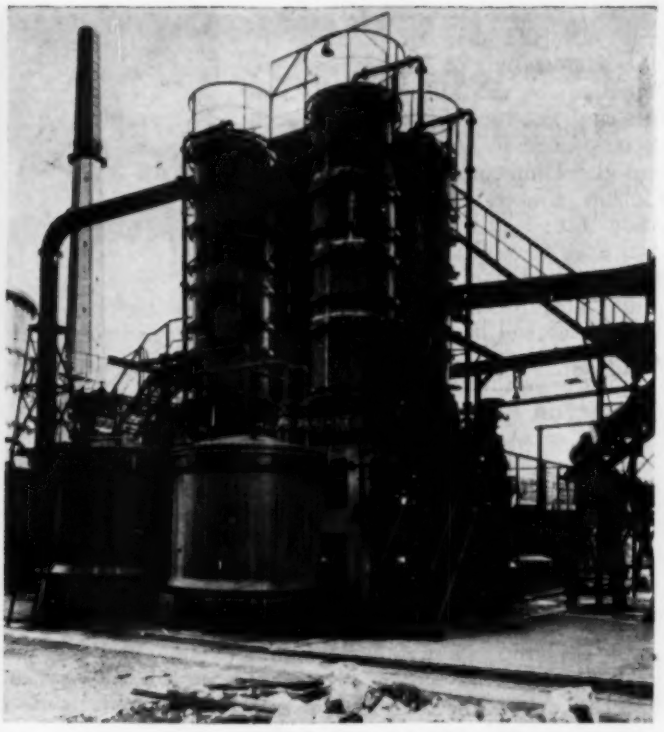
Production Record

During capacity tests, the plant ran at its design rate of 2,800 bbl. per day of finished xylidine. Total production exceeded 200,000 bbl. of which more than 150,000 was shipped and blended. The final report of PAW showed that CS had been responsible for an additional 4,500,000 bbl. of high performance gasoline. Practically all of the CS used in this manner was produced at Cactus.

By the end of 1944 the military picture had changed considerably. Many new 100-octane plants had been finished. Germany had been softened by the invasion, and ammonia for explosives manufacture was again much in demand. Xylidine production was hence stopped, and six months later the same plant was producing anhydrous ammonia.



FERTILIZER: Nitrogen slated to double by 1950. (Above, mills at Saint Gobain's Chauny plant)



CAUSTIC-CHLORINE: Seawater electrolysis up 70 percent. (Above, HCl end of Saint Gobain plant at Saint Fons)

France Plans Chemical Expansion

Recent reports itemize French needs, capacities and expansion programs.

Michael Marsh
McGraw-Hill World News

For several months industry representatives and government technicians representing the different branches of chemical processing in France have been meeting to draw up future production and modernization plans to fit into the general scheme of France's Monnet Plan. Reports covering numerous branches such as sulphuric acid, nitrogen, dyes, films, resins, tars, detergents, pharmaceuticals, and alkalis have now been prepared. These reports give a clear picture of the situation in different fields covered and of some of the recent trends. They also show what the industry would like to do in the way of expanding output. They are still not fully integrated together, however, so they offer only a general guide to future developments.

Sulphuric Acid

Output of sulphuric acid last year was 1,053,000 metric tons, about 15 percent below 1938, but representing steady progress from very low rates in 1945. During the first four months of this year production increased still further and pushed above the prewar rate to 110,000 tons in April. Needs for the current year are expected to total about 1,400,000 tons, while an estimate of some 2,000,000 tons is given for needs in 1950.

Sixty-five plants are at present active in the industry, with most of them serving a regional market because of the transportation factor and most of them being considerably below the optimum size. Most of the plants use the chamber technique. Of total capacity, chamber capacity is 1,173,000 tons (65 percent of it over 20 years old), and contact capacity is 316,000 tons (also largely old equipment).

Back of the old age of these installations lie two factors which have operated throughout the chemical industry here since the beginning of the war. First, there has been great shortage of metal and fuel to make new equipment. Second, France has been in a period of rampant inflation since 1939. With prices being multiplied by ten or more, with great expansion in working capital needs and with depreciation charges lagging behind replacement costs, companies are in a poor position to modernize. Fortunately, materials, finances and psychology now seem on the mend.

In the sulphuric acid field, the producers hope to increase capacity by 600,000 tons over the next few years (60 percent contact, and 40 percent chamber). Some of these projects are already under way.

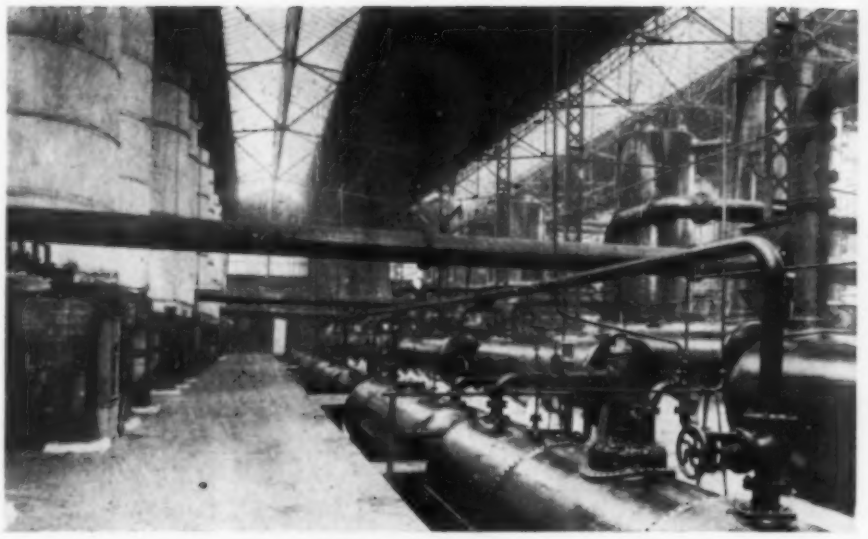
Most of the plants now operating in France have capacities far under 100 tons daily, which is estimated to be the minimum optimum size for plants here. The new plants, however, will generally be of this size.

It is estimated that for a plant of 100 tons daily the cost using the lead-chamber process is only 88 percent of the cost of a similar contact capacity, while with chambers using oxides of nitrogen the cost falls to 79 percent that of contact units. Some technicians point out however that a larger-scale contact setup, coupled with flash-roasting of the pyrites (the latter has so far not been employed in

France), could compete very favorably with the chamber process.

Modernization of the chamber installations by the Mills-Packard, Gaillard and Petersen processes has been accomplished by some French plants, and the Dior company of the Saint-Gobain group is now building a plant using the Kachkaroff process. This uses exterior-cooled steel chambers instead of lead ones for producing sulphuric and nitric acids together. The Dior plant will have daily capacity of 100 tons of sulphuric acid and 25 tons of nitric. A similar plant is already operating in Italy.

Some experimentation is going on to develop use of other sources of sulphur, since France's domestic production of pyrites is far from sufficient.



SULPHURIC ACID: Last year 1,000,000 tons, 2,000,000 by 1950. (Above, Part of Kuhlmann's sulphuric plant at La Madeleine)

Nitrogen

In the nitrogen field a very considerable expansion of synthetic facilities is hoped for, in order to relieve France's dependence on foreign supplies of natural nitrates and at the same time largely increase the supply of fertilizers.

Apart from relatively small quantities obtained from carbonization of coal, from the cyanimide industry and in organic form, France's present 19 synthetic plants have a practical capacity of 252,000 tons of nitrogen a year. The producers hope to raise this to 383,000 tons or more by 1950. A similar increase in capacity for conversion to nitric acid is envisaged. Whether this new capacity can be fully used depends of course on supplies of fuel and materials, and the supply of these is in doubt. Estimates of 1948 output are only about 200,000 tons, largely because of materials shortages. A difficult financing problem also exists.

As a source of hydrogen for the synthetic ammonia (apart from the coke, coke oven gas and water gas currently in use) it is planned to install a Winckler gas generator for use in the Provence coal field. Other possible sources are natural gas in southwest France, for which cracking installations are now under way, and the cracking of heavy fuel oil.

Producers have also set up a long range expansion goal to raise practical capacity to 619,000 tons, making large use of these new sources. This further new capacity will be necessary to realize the post-1950 goal of 500,000 tons of nitrogen for fertilizers, compared to prewar consumption of about 200,000 tons; to say nothing of the 10 percent of nitrogen output needed by industry.

Fertilizer capacity is also tentatively slated to double, in terms of nitrogen consumption, from 300,000 tons currently to 645,000 tons after 1950.

Film and Resin

A virtual revolution has come over the French film-making industry, with output for different types of film last year ranging from 50 to 1,000 percent above prewar. Value of products equalled $20 million in 1947. Of this, 16 percent was exported, while imports totalled only 5.5 percent of domestic output. This is in contrast to prewar, when out of an output half as large as last year's only 5 percent was exported, and imports totalled nearly 25 percent.

What has happened is that German dumping is now removed, American and British producers can hardly satisfy their domestic markets, and Western Europe has imposed exchange restrictions against the American product. As a result France is not only satisfying a much larger portion of the local demand, but has been exporting to neighboring countries where it never had a market before. Nevertheless the industry (composed of nine companies of varying size) estimates that neither French nor Western European export demand is yet satisfied.

In the field of natural resins, furnished chiefly from the vast pine forests of Southwestern France, there is little chance that the important prewar exports of either dry products or turpentine will be resumed in the next few years. Output still has far to go to reach the 1939 level of 26.4 million gal. of resin, and domestic demands will probably continue to exceed supply. In fact, imports will continue to be necessary.

Dyestuffs

The French dyestuffs industry is now practically a monopoly, a trust called Francolor having been formed under German auspices during the war. In addition to the four plants of Francolor (whose stock is now 51 percent owned by the French state), the Ciba company has a small plant and there are three other very small plants.

French dye plants were not much damaged during the war, and the industry hopes by modernization and considerable expansion not only to meet domestic needs but to cut into the export market formerly dominated by I. G. Farben. It is felt the export market could take 10,000 tons of French dyestuffs now, compared to 4,000-5,000 before the war. This is far

Dyestuff Needs, Production and Capacity

(metric tons)

	Current Needs				Production 1947	Present Capacity
	France	Fr. Empire	Export	Total		
Azoic	6,770	550	5,000	12,320	7,928	8,757
Triphenylmethane and various	1,167	100	1,000	2,267	615	1,000
Sulphur-base	1,100	100	2,000	3,200	2,936	3,276
Vat colors	2,403	200	2,000	6,558	282	325
Others	1,880	105			1,017	1,533
Total	13,320	1,055	10,000	24,375	12,788	14,891
Indigo	300	?	?	?	2,600	5,400

SYNTHETIC NITROGEN: Last year 252,000 tons, 383,000 by 1950. (Above, Kuhlmann's goodlooking nitrate plant, La Madeleine)

from supplanting the needs left by the collapse in German output from over 60,000 tons in 1939 to around 6,000 tons last year. In fact the hope nearly to double 1947 French output to 24,375 tons (aside from indigo) will, even if realized, only enable France to supply a small share of I. G. Farben's former customers.

The general French dyestuffs picture can best be shown by the accompanying table:

Coal Tar

In the field of tars and their derivatives, the French find their capacity lagging behind demand for most products. Soon though, considerable expansion will be completed, and by 1951 many shortages probably will be overcome. The accompanying table shows the expected situation this year, and the hoped-for development in 1951, for the principal products.

Coal tar refining capacity for total distillation is currently about 800,000 tons of tar annually, plus another couple of hundred thousand tons of partial distillation capacity, bringing the total to about 800,000 tons. Two hundred thousand tons of new total-distillation capacity will be added, of which 155,000 tons is now under construction and due for service by early 1949. This will bring 1951 total capacity to about a million tons. A number of new installations for secondary treatment are also under construction or planned.

Result of this new program will be largely to shift French import needs from refined products to crude coal tar. Imports of benzol and solvents last year, for example, totalled 14,000 tons; but by 1949 France should supply all her own needs for these.

Domestic supplies (plus Saar shipments) of coal tar were only 415,000 tons last year, are estimated at 460,000 tons this year, and aren't expected to be much over 650,000 tons by 1951. This means that up to 250,000 tons of foreign crude tar must be imported to feed the new refineries and satisfy French needs. This is looked for first from the Ruhr, and then from Britain and the U. S.

In addition, last year's imports from the U. S. and Britain of 275,000 tons of pitch and 250,000 tons of prepared tar, must be increased over the next few years if higher needs are to be met.

Tar Product Situation
(metric tons)

Product	1948 Needs	1948 Resources	1951 Needs	1951 Resources
Phenol	16,000	1,100*	22,000	22,000†
Cresols	4,000	2,200	7,300	3,300
Xylenols	2,000	1,100	4,000	1,800
Naphthalene	20,000	15,000	30,000	22,000
Anthracene 40 percent	4,200	1,800	5,200	2,500
Pyridine 113/117	30	10	100	?
Coumarone resin	1,000	400	1,200	800
Benzene	29,000	24,000	40,400	35,000
Toluene	4,500	4,000	8,400	8,000
Xylene	1,000	500	1,200	1,000
Benzene and solvents	54,000	51,000	61,000	65,000
Pitch	490,000	150,000	600,000	220,000
Prepared tar for roads	485,000	150,000	540,000	250,000
Oils	110,000	100,000	140,000	140,000

*Natural. †Natural and synthetic from benzene.

Detergents and Drugs

In the soap and detergent field, the grave shortage of materials for natural soaps is expected to continue. Last year the traditional soap industry received only 75,000 tons of fats, oils and resins, and prospects for this year are not much higher. Needs are estimated currently at 280,000 tons, and capacity at 500,000 tons.

In the face of this shortage synthetic detergents have already had a certain boom, output last year being about 9,000 tons (in active matter) and current capacity being 17,000 tons. The industry hopes to expand output to 14,700 tons this year, 28,300 tons in 1949, and 50,000 tons in 1950. Different types to be produced this year break down as follows (in tons of active matter):

Detergents	Tons
Sulphonated oils	5,430
Sulphonated alcohols	3,227
Sulphonated amides	4,266
Sulphonated alkyl-naphthalene	760
Sulphonated alkyl-aryl	10,620
Quaternary ammonium salts and other	3,338

In pharmaceuticals the industry hopes to reach 170 percent of the 1938 level by 1950. This would enable them not only to satisfy domestic demand, but to recapture some of the lost South American markets and in general to compete for the ex-German markets with American and British firms.

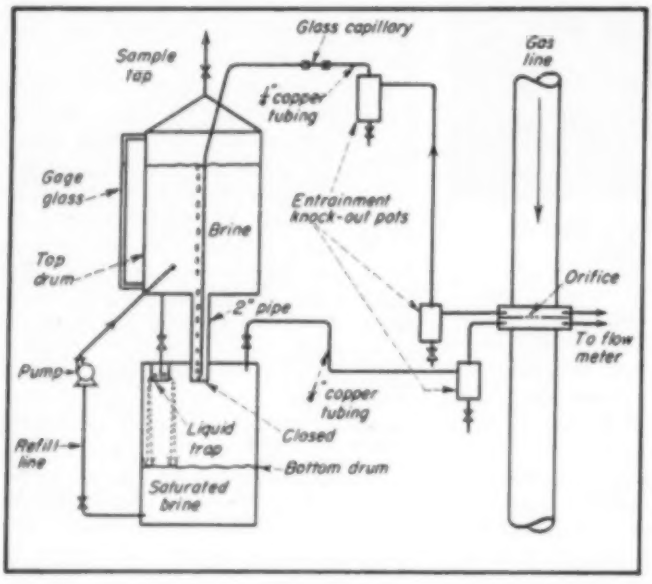
Alkalis

So far as soda products are concerned, the French industry—composed of eight plants—shows a constant upward trend and has far outdistanced 1938 output. Output of soda ash was 595,000 tons last year and reached a rate of 720,000 tons in April 1948, compared to 480,000 tons in 1938. For caustic soda, 1947 output was 170,300 tons, April 1948 was at a rate of 192,000 tons, and prewar was only 107,000 tons.

Despite an expected further expansion in demand and a continuation of high exports, present capacity should largely suffice for the next few years, it is felt. Present capacities are: soda ash, 787,000 tons; caustic soda, 355,000 tons; bicarbonate of soda, 28,000 tons; and calcium chloride, 36,000 tons. The principal expansion planned is an extension of 70,000 tons to be the present 100,000 tons capacity for obtaining electrolytic caustic soda from sea water.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR



Continuous Collector Samples Gases in Proportion to Main Line Flow

ADAM A REEVES
U. S. Bureau of Mines, Oil-Shale Demonstration Plant
Rifle, Colo.

August Contest Prize Winner

IN OUR WORK it became necessary to obtain a continuous composite sample of a gaseous mixture whose rate of flow and composition both varied with time. This was done by using a small glass orifice (actually a capillary) which would pass a proportional amount of the flow through the main gas orifice, and maintain essentially the same pressure drop across the sample orifice as that across the main orifice.

The sample tube enters the top drum shown in the sketch and passes to the bottom of a 2-in. pipe connecting the two drums, but closed at the bottom. The end of the tube is at the same level as the liquid trap in the bottom drum. This trap is connected to the top drum by a column of liquid. Thus, the pressure of the gas in the lower drum is practically the same as the pressure on the downstream side of the sample orifice. Therefore, the two orifices have the same differential pressures and the flows are proportional. The gas sample collects in the dome of the upper vessel and the pressure is equalized by liquid flowing into the lower container.

Glass capillary tubes are easily fabricated using a regular ¼-in. piece of tubing and rotating it in a hot flame until the tubing forms a constriction without pulling on the tubing. Capillaries of different sizes were made and calibrated. Entrainment knock-out pots were installed on the sample tubing to prevent the possibility of brine getting into the main gas line. Saturated brine is used to minimize errors due to solution of gas components in the liquid medium.

The drums used are regular 55-gal. drums. A conical top was made for the top drum so that all of the gas could be expelled through the sample tap during refilling. The gas sample is forced into the sample bottle by displacement and the liquid is raised into the top vessel until it issues from the sample tap.

More on Mental Temperature Conversion

THOMAS H. ELMER
Nepa Div., Fairchild Engine & Airplane Corp.
Oak Ridge, Tenn.

IN THE July 1948 issue of the Plant Notebook Walter Lisowski described two methods for converting temperature. The method described by him for converting deg. C. to deg. F. consists of multiplying deg. C. by 2, subtracting 10 percent of the product, and adding 32. This simple arithmetical calculation is indeed very helpful for making mental conversion calculations, and I have found it useful many times in my work.

The second method described by him shows how to convert deg. F. to deg. C. and is not quite so simple to perform mentally as the first. In order to obtain an approximate answer this method requires the following steps: subtract 32 from deg. F., divide by 9, divide the result by 2 and multiply by 10.

The purpose of this note is to derive a simpler expression which is readily adaptable to mental calculation.

First I wish to indicate that the process for converting deg. F. to deg. C represents strictly a division by 1.8 of the number remaining after subtracting 32. Mathematically, this step of division may be represented as follows:

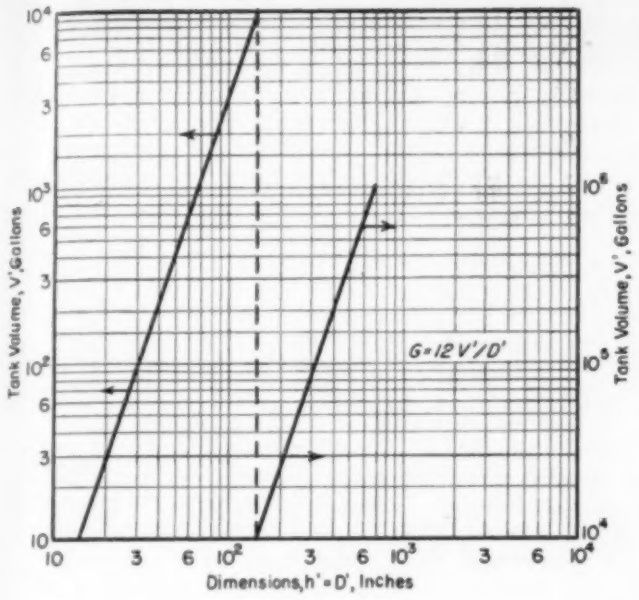
$$1/1.8 \times (\text{deg. F.} - 32) = \text{deg. C.} \qquad (1)$$

I would like to point out that the expression 1/1.8 can be represented by the following series:

$$\frac{1}{1.8} = \frac{1}{2} + \frac{1}{20} + \frac{1}{200} + \frac{1}{2{,}000} + \ldots \qquad (2)$$

It will be noted that the terms of the series contain only the number 2, a number readily usable in our mental processes. By applying the first two terms of the series in place of 1.8 in Equation (1), one obtains a value in deg. C which will always be within 1 percent of the correct value. Using three terms will give results accurate to within 0.1 percent of the correct value.

The series approach method adapts itself readily for mental calculations and offers a simple way of converting deg. F. to deg. C. The method can be best illustrated by means of examples, i.e., 212 deg. F. − 32 = 180; 180 ÷ 2 = 90; 180 ÷ 20 = 9; 90 + 9 = 99 deg. C. Also, 2,350 deg. F. − 32 = 2,318; 2,318 ÷ 2 = 1,159; 2,318 ÷ 20 = 116; 2,318 ÷ 200 = 11.6; 1,159 + 116 + 11.6 = 1,286.6 deg. C. The correct value is 1287.7 C.



Method for Estimating Dimensions of Vertical Cylindrical Tanks

STANLEY YOKELL
Chemical Engineer, Columbia Equipment Co.
Newark, N. J.

FREQUENTLY it is necessary to find the most economical tank size for a given tank capacity. This can be done by the use of a logarithmic plot of the relationship of diameter and volume that satisfies this condition. In addition, substitution of values obtained from this plot in a simple equation will give the number of gallons per foot of depth for any given tank diameter.

Let V = volume of tank, cu. ft.; V' = volume of tank, gal.; A = area of inside surfaces, sq. ft.; D = inside diameter of tank, ft.; D' = inside diameter of tank, in.; h = height of tank, ft.; h' = height of tank, in.; and G = gallons per foot of depth. Then, the total inside area of the tank is

$$A = 2\pi D^2/4 + \pi Dh$$
$$V = \pi D^2 h/4$$

Transposing and substituting

$$A = \pi D^2/2 + 4V/D$$

Differentiating and setting the derivative equal to zero,

$$D = 0.555\ (V')^{1/3}$$

Similarly:

$$h = 0.555\ (V')^{1/3}$$

Converting to inches,

$$D' = h' = 6.66\ (V')^{1/3}$$

This equation plotted on logarithmic paper yields the accompanying chart.

To find the most economical dimensions for any given volume, read the volume on the left of the chart. The corresponding diameter or height is found below the curve.

To find the volume per foot of depth for any diameter, read the volume corresponding to the diameter on the chart and substitute in the formula:

$$G = 12V''/D'$$

For example:

1. What is the diameter and height of the most economical tank of 1,000 gal. capacity? From the chart, $D' = h' =$ 66.6 in. These figures should be rounded off to the next highest whole number of inches.

2. How many gallons per foot of depth are there in a 10-ft. diameter tank? $D' = 120$, and from the chart, $V' = 5{,}850$. Then: $G = 12 \times 5{,}850/120 = 585$ gal. per ft. The corresponding value from Table 35, "Chemical Engineers Handbook," 2nd Edition (McGraw-Hill, New York, 1941) is 587.52.

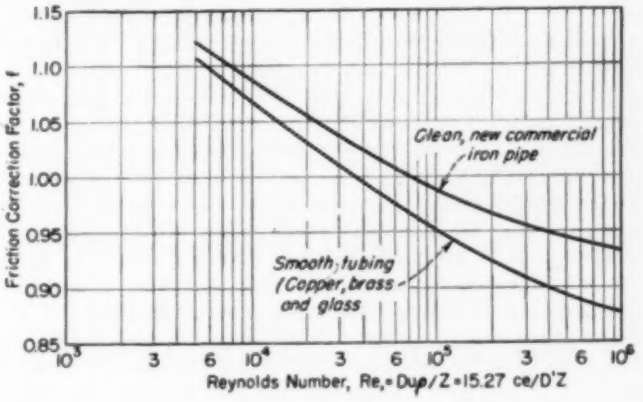
September Prize Winner

A $50 prize will be issued to

Melvin Nord
Nord and Co., Keyport, N. J.

For an article presenting a novel design for a reflux splitter for distillation columns which operates properly even when water is present in the condensate. It has been judged the winner of our September contest.

This article will appear in our November issue. Watch for it!


Friction Correction Factor, f
Clean, new commercial iron pipe
Smooth tubing (Copper, brass and glass
Reynolds Number, Re = Duρ/Z = 15.27 ce/D'Z

How to Select Pipe Sizes for Definite Pressure Drop

JOSEPH I. LACEY
Hooker Electrochemical Co.
Niagara Falls, N. Y.

ENGINEERS often have to calculate the diameter of a pipe so that the pressure drop will not exceed a specified limit for a given fluid flow and length. The standard method is to assume a diameter, calculate the Reynolds number, find the friction factor from a curve, and calculate the pressure drop. If the assumption is wrong, further trials must be made until the conditions are satisfied. For practical purposes this method can be considerably simplified as follows:

The friction factor curves have been expressed mathematically (Drew, Koo and McAdams, *Trans.* AIChE, 28, 56, 1932) for clean iron pipe as:

$$\Delta HD/Lu^2 = 0.0001906 + 0.01171/Re^{0.32} \qquad (1)$$

The left side of this equation may be rearranged as:

$$\Delta HD/Lu^2 = (D')^5 \Delta P/c^2 L\rho \qquad (2)$$

where ΔH = pressure drop, ft. of fluid; D = pipe diameter, ft.; L = pipe length, ft.; u = linear flow velocity, ft. per sec.; Re=Reynolds number=$Du\rho$/viscosity; D'=diameter, in.; ΔP = pressure drop, psi.; c = average volume flow rate, cfs.; and ρ = fluid density, lb. per cu. ft. Substituting Equation (2) in (1) and solving for D' we have:

$50 Cash Prize For a Good Idea!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e. g., the October winner will be announced in November and his article published in December. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

$$D' = (c^2 L\rho/\Delta P)^{1/5} [2{,}801.3\ (0.0001906 + 0.01171/Re^{0.32})]^{1/5} \quad (3)$$

Letting f = the second term on the right, within the brackets, and noting that $c^2\rho = w^2\rho$ where w = flow rate in lb. per sec., then

$$D' = f\ (c^2 L\rho/\Delta P)^{1/5} = f\ (w^2 L/\rho\Delta P)^{1/5} \quad (4)$$

A similar derivation can be made for smooth tubing. Values of f at various values of Reynolds numbers for iron pipe and smooth tubing are presented in the accompanying curves.

For values of Re between 6,000 and 1,000,000 the value of f varies less than 12 percent from unity. The smallest increase in successive standard iron pipe inside diameters (up to 12 in) is from 3½ to 4 in., which has a percentage increase of 14 percent. Other sizes increase as much as 35 percent (⅛ in. i.p.s. to ¼ in. i.p.s.) with an average of 24 percent. Thus, if the pipe line is to be made of iron pipe, or some other material that jumps in corresponding sizes, and it is assumed that the flow is turbulent, then the value of f in Equation (4) may be taken as one. If either, or one, of these assumptions cannot be made, make a first approximation using $f = 1.0$ to get D'; calculate Re; and get the proper value of f from the curves. Correct D' by multiplying by f. Although this will not give a mathematically correct result it will be sufficiently close for all practical purposes and will be closer than the limits of accuracy of the basic Equation (1).

The value of f for streamline flow, regardless of type of tube or pipe, is expressed by

$$f = (2801.3/Re)^{1/5} \quad (5)$$

For values of Re below 1,750, the value of f is greater than 1.15. It is recommended that f be calculated and applied to Equation (4) when dealing with streamline flow.

Table Aids Evaluation of Factorials

HAROLD R. FRISBIE
Chemical Engineer
Rodeo, Calif.

IN MANY LINES of scientific work—e.g., in statistical studies of physical, biological, and social phenomena, in the theory of errors of measurement, etc.—the theory of chance plays an important part.

In the determination of the chance, or probability of an event, it is often necessary to calculate factorials. To reduce the work necessary to evaluate these factorials, the accompanying table was prepared.

Any factorial, from 2 to 100, may be read directly from Table I, correct to five significant figures as prepared from six place logarithms.

A permutation such as $P_{n,\,r}$ [$P_{n,\,r} = (n)\ (n-1)\ \ldots\ (n-r+1)$] may be rewritten:

$$P_{n,\,r} = \frac{(P_{n,\,r})\ (P_{n-r,\,n-r})}{(P_{n-r,\,n-r})} = \frac{(P_{n,\,n})}{(P_{n-r,\,n-r})} = \frac{n!}{(n-r)!}$$

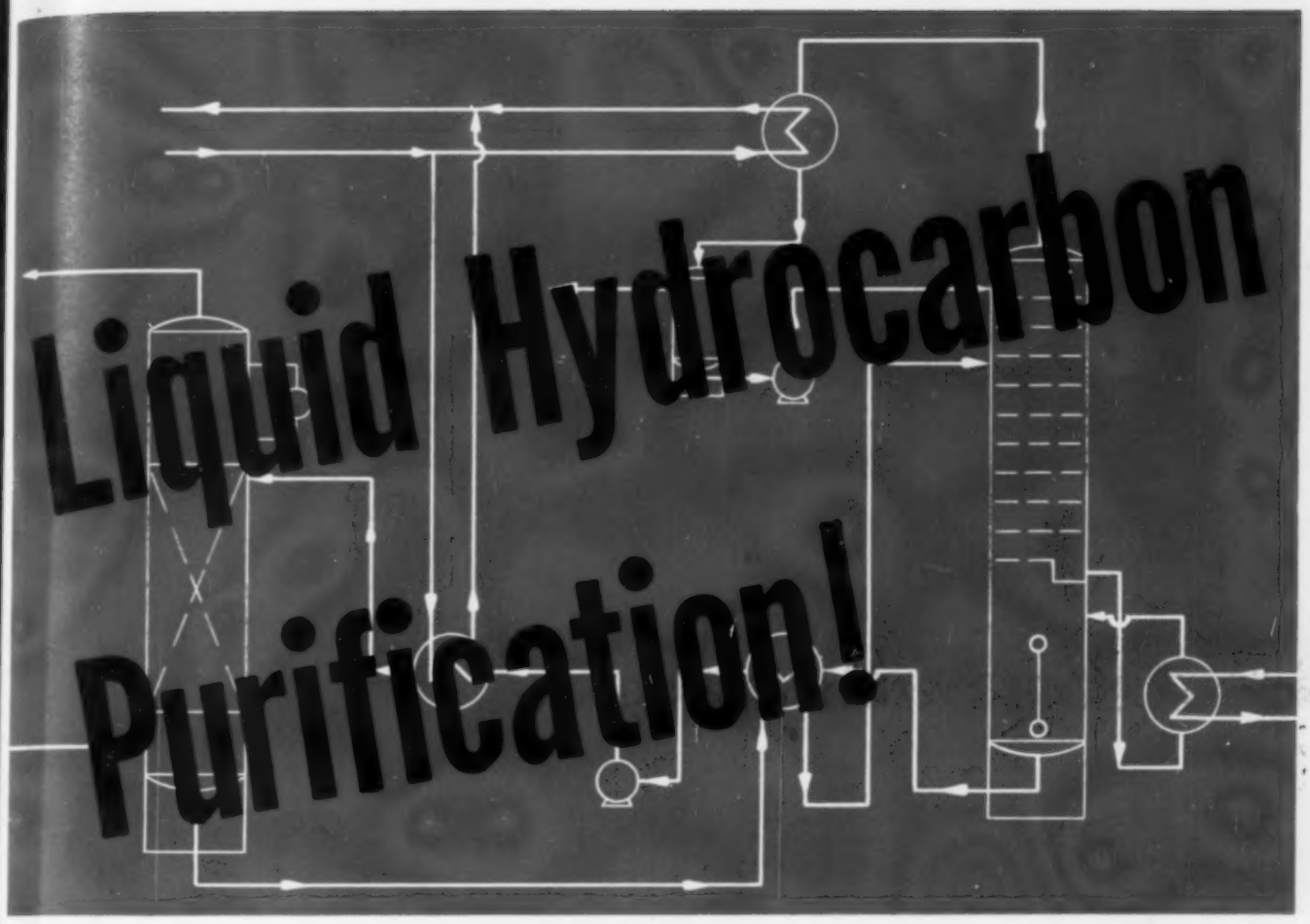
from which:

$$\log_{10} P_{n,\,r} = \log_{10} n! - \log_{10}(n-r)!$$

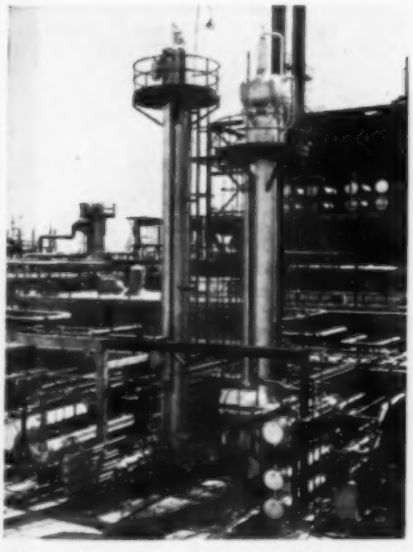
The values of $\log_{10} n!$ and $\log_{10}(n\text{-}r)!$ may be obtained from the table. The $\log_{10} P_{n,\,r}$ may then be determined by difference and the value of $P_{n,\,r}$ obtained from any log table.

Values of Factorials and Their Logarithms

n	log n	log n!	n!
2	0.301030	0.301030	2.0000
3	0.477121	0.778151	6.0000
4	0.602060	1.380211	2.4000 × 10
5	0.698970	2.079181	1.2000 × 10^2
6	0.778151	2.857332	7.2000 × 10^2
7	0.845098	3.702430	5.0400 × 10^3
8	0.903090	4.605520	4.0320 × 10^4
9	0.954243	5.559763	3.6288 × 10^5
10	1.000000	6.559763	3.6288 × 10^6
11	1.041393	7.601156	3.9917 × 10^7
12	1.079181	8.680337	4.7900 × 10^8
13	1.113943	9.794280	6.2270 × 10^9
14	1.146128	10.940408	8.7178 × 10^{10}
15	1.176091	12.116499	1.3077 × 10^{12}
16	1.204120	13.320619	2.0923 × 10^{13}
17	1.230449	14.551068	3.5569 × 10^{14}
18	1.255273	15.806341	6.4024 × 10^{15}
19	1.278754	17.085095	1.2165 × 10^{17}
20	1.301030	18.386125	2.4329 × 10^{18}
21	1.322219	19.708344	5.1091 × 10^{19}
22	1.342423	21.050767	1.1240 × 10^{21}
23	1.361728	22.412495	2.5852 × 10^{22}
24	1.380211	23.792706	6.2045 × 10^{23}
25	1.397940	25.190646	1.5511 × 10^{25}
26	1.414973	26.605619	4.0329 × 10^{26}
27	1.431364	28.036983	1.0889 × 10^{28}
28	1.447158	29.484141	3.0489 × 10^{29}
29	1.462398	30.946539	8.8418 × 10^{30}
30	1.477121	32.423660	2.6525 × 10^{32}
31	1.491362	33.915022	8.2228 × 10^{33}
32	1.505150	35.420172	2.6313 × 10^{35}
33	1.518514	36.938686	8.6833 × 10^{36}
34	1.531479	38.470165	2.9523 × 10^{38}
35	1.544068	40.014233	1.0333 × 10^{40}
36	1.556303	41.570536	3.7199 × 10^{41}
37	1.568202	43.138738	1.3764 × 10^{43}
38	1.579784	44.718522	5.2302 × 10^{44}
39	1.591065	46.309587	2.0398 × 10^{46}
40	1.602060	47.911647	8.1592 × 10^{47}
41	1.612784	49.524431	3.3453 × 10^{49}
42	1.623249	51.147680	1.4050 × 10^{51}
43	1.633468	52.781148	6.0415 × 10^{52}
44	1.643453	54.424601	2.6583 × 10^{54}
45	1.653213	56.077814	1.1962 × 10^{56}
46	1.662758	57.740572	5.5026 × 10^{57}
47	1.672098	59.412670	2.5862 × 10^{59}
48	1.681241	61.093911	1.2414 × 10^{61}
49	1.690196	62.784107	6.0828 × 10^{62}
50	1.698970	64.483077	3.0414 × 10^{64}
51	1.707570	66.190647	1.5511 × 10^{66}
52	1.716003	67.906650	8.0659 × 10^{67}
53	1.724276	69.630926	4.2749 × 10^{69}
54	1.732394	71.363320	2.3084 × 10^{71}
55	1.740363	73.103683	1.2696 × 10^{73}
56	1.748188	74.851871	7.1100 × 10^{74}
57	1.755875	76.607746	4.0527 × 10^{76}
58	1.763428	78.371174	2.3506 × 10^{78}
59	1.770852	80.142026	1.3868 × 10^{80}
60	1.778151	81.920177	8.3210 × 10^{81}
61	1.785330	83.705507	5.0758 × 10^{83}
62	1.792392	85.497899	3.1470 × 10^{85}
63	1.799341	87.297240	1.9826 × 10^{87}
64	1.806180	89.103420	1.2689 × 10^{89}
65	1.812913	90.916333	8.2477 × 10^{90}
66	1.819544	92.735877	5.4435 × 10^{92}
67	1.826075	94.561952	3.6471 × 10^{94}
68	1.832509	96.394461	2.4801 × 10^{96}
69	1.838849	98.233310	1.7112 × 10^{98}
70	1.845098	100.078408	1.1979 × 10^{100}
71	1.851258	101.929666	8.5048 × 10^{101}
72	1.857332	103.786998	6.1235 × 10^{103}
73	1.863323	105.650321	4.4701 × 10^{105}
74	1.869232	107.519553	3.3079 × 10^{107}
75	1.875061	109.394614	2.4809 × 10^{109}
76	1.880814	111.275428	1.8855 × 10^{111}
77	1.886491	113.161919	1.4518 × 10^{113}
78	1.892095	115.054014	1.1324 × 10^{114}
79	1.897627	116.951641	8.9463 × 10^{115}
80	1.903090	118.854731	7.1570 × 10^{117}
81	1.908485	120.763216	5.7972 × 10^{119}
82	1.913814	122.677030	4.7537 × 10^{121}
83	1.919078	124.596108	3.9456 × 10^{123}
84	1.924279	126.520387	3.3143 × 10^{125}
85	1.929419	128.449806	2.8171 × 10^{126}
86	1.934498	130.384304	2.4227 × 10^{128}
87	1.939519	132.323823	2.1078 × 10^{130}
88	1.944483	134.268306	1.8548 × 10^{132}
89	1.949390	136.217696	1.6508 × 10^{134}
90	1.954243	138.171939	1.4857 × 10^{135}
91	1.959041	140.130980	1.3520 × 10^{137}
92	1.963788	142.094768	1.2439 × 10^{139}
93	1.968483	144.063251	1.1568 × 10^{141}
94	1.973128	146.036379	1.0874 × 10^{143}
95	1.977724	148.014103	1.0330 × 10^{145}
96	1.982271	149.996374	9.9169 × 10^{146}
97	1.986772	151.983146	9.6194 × 10^{148}
98	1.991226	153.974372	9.4270 × 10^{150}
99	1.995635	155.970007	9.3328 × 10^{152}
100	2.000000	157.970007	9.3328 × 10^{157}



You remove H_2S economically when you do it with a Girdler Girbotol Plant



GIRBOTOL unit recently designed, engineered, and constructed by Girdler for a west coast refinery. According to leading authorities, plants of this type present the most efficient means of hydrocarbon purification, gas phase or liquid phase.

Girdler's GIRBOTOL Process, long noted for effective and economical hydrogen sulphide removal in the gaseous phase, has been adapted with equal effectiveness and economy to the important business of taking hydrogen sulphide out of butane, propane, poly-feed stocks, straight run naphthas and gasoline.

Proof is in the growing list of refiners who are finding it profitable to use Girdler GIRBOTOL plants for this purpose. Twenty plants are now operating or under construction.

If you have a liquid stream that contains 500 pounds or more of hydrogen sulphide per day, a Girdler GIRBOTOL plant will save money. Investigate. There is no spent reagent disposal problem.

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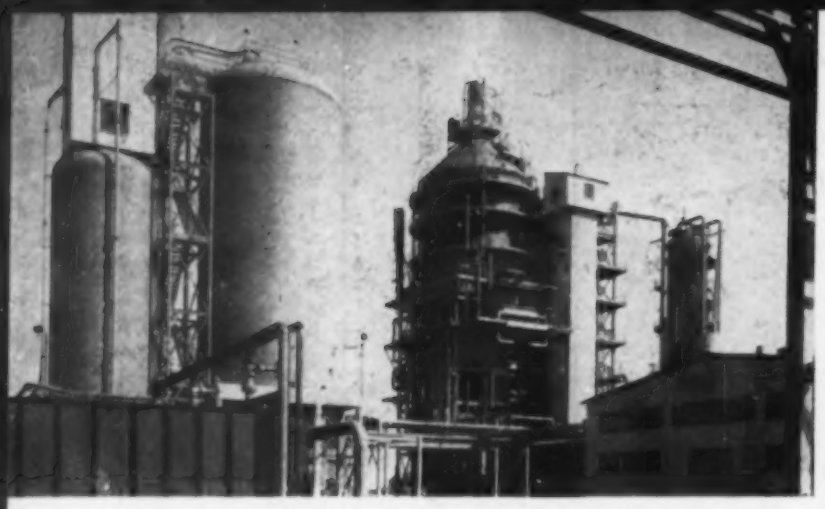
Girdler's versatile, practical experience includes processes for gas manufacture, purification, separation, dehydration — processes involving hydrogen sulphide, hydrogen chloride, carbon monoxide, carbon dioxide, inert and controlled atmospheres, natural gas, synthesis gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen, elemental sulphur.

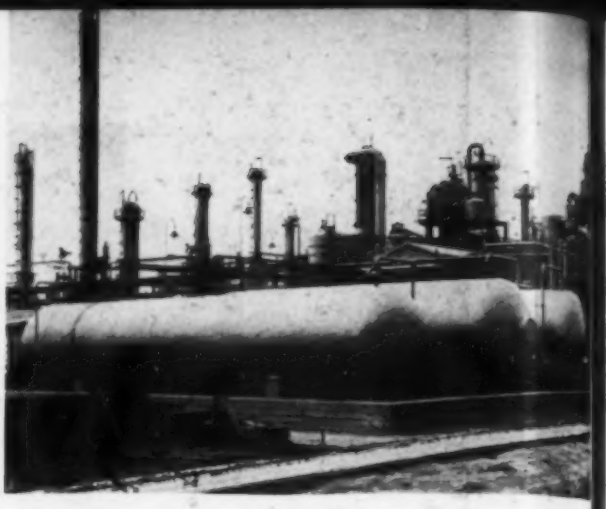
THE GIRDLER CORPORATION, GAS PROCESSES DIVISION, LOUISVILLE 1, KY.

150 Broadway, New York City 7 • 2612 Russ Bldg., San Francisco 4 • 311 Tuloma Bldg., Tulsa 3

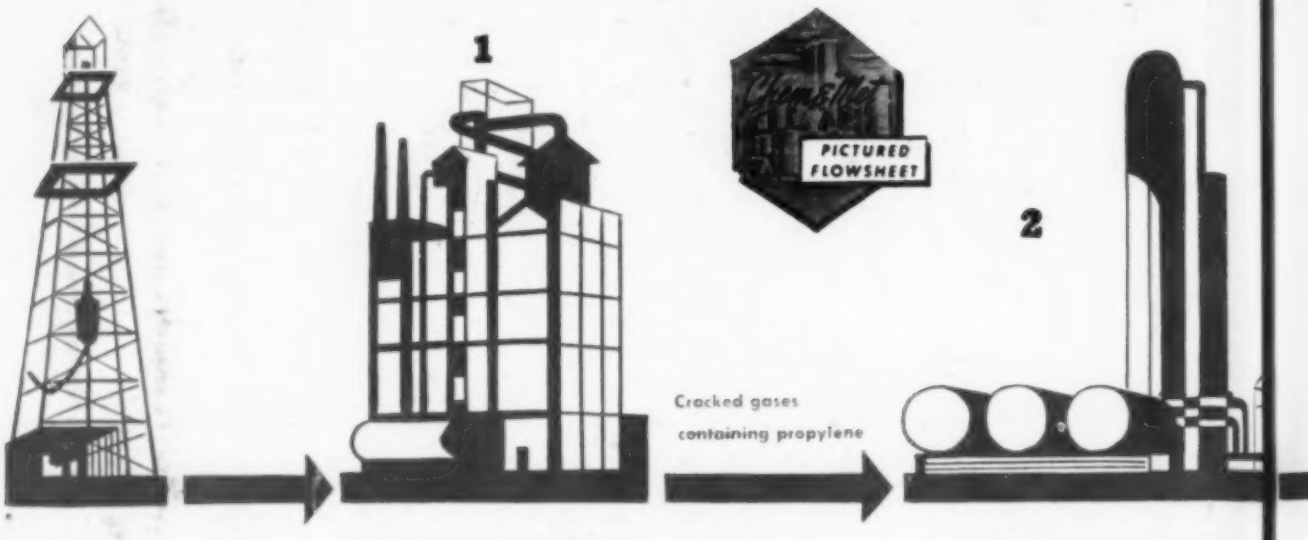
Designers, Engineers, & Constructors in GAS PROCESSES



1 Cracked gases containing propylene are made in this catalytic unit for feed stock in the glycerine plant



2 Propylene is purified, stored in these pressure tanks and fed to the allyl chloride synthesis unit



Glycerine by Synthesis

1948 Award-Winning Chemical Engineering Achievement. See Page 97

Synthesis of glycerine on a commercial scale is now underway in the new $8 million plant of the Shell Chemical Corp. at Houston, Tex. This is the world's first large-scale unit. It promises to add appreciably to the prewar output of this essential chemical.

The process starts with propylene, which is chlorinated at temperatures in excess of 500 deg. C. Allyl chloride is then converted through a series of reactions to a crude glycerine solution, which is concentrated, desalted and purified.

From a chemical standpoint, Shell's most significant achievement resulted from research on the mechanism of chlorination reactions. Contrary to what was generally believed at the time concerning the behavior of chlorine and olefin hydrocarbons, pioneer work in the Emeryville, Cal., laboratories of the Shell Development Co. proved that it was possible to substitute chlorine in the propylene molecule without affecting the more reactive double bond. This paved the way for a practical synthesis of allyl chloride.

The pure allyl chloride obtained from this reaction can be converted to glycerine by a variety of processes. Reaction with chlorine at 20 deg. C. will yield 1,2,3 trichloropropane, which can be readily hydrolyzed to glycerine. Reaction with hypochlorous acid gives glycerol mono- and di-chlorhydrins. Or by catalytic reaction with an alkali, allyl chloride can be converted to allyl alcohol, which in turn reacts with HOCl to form the chlorhydrins. All of these processes have as their end products a dilute solution of glycerine and salt.

The next steps consist of concentration, desalting and purifying the crude glycerine. The raw solution is pumped to multiple-effect evaporators, which contain over a quarter of an acre of heating surface. The salt-glycerine slurry is settled prior to further concentration, desalting and final purification by vacuum distillation.

The purified glycerine is pumped to specially lined storage tanks until ready for shipment in Shell's new fleet of made-to-order aluminum tankcars.

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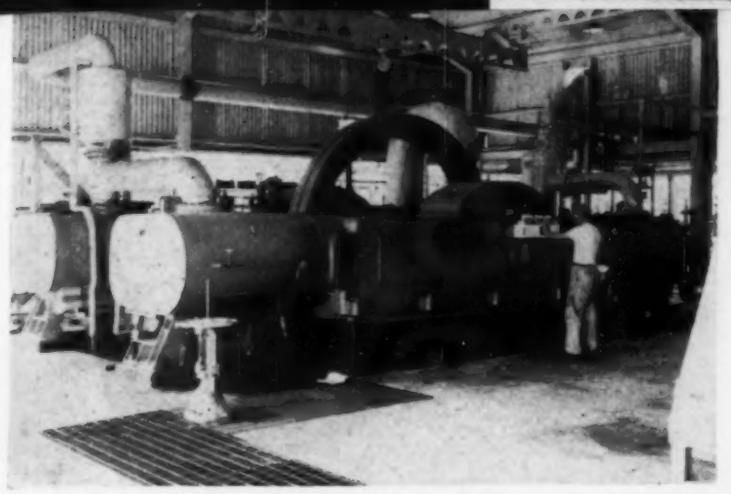
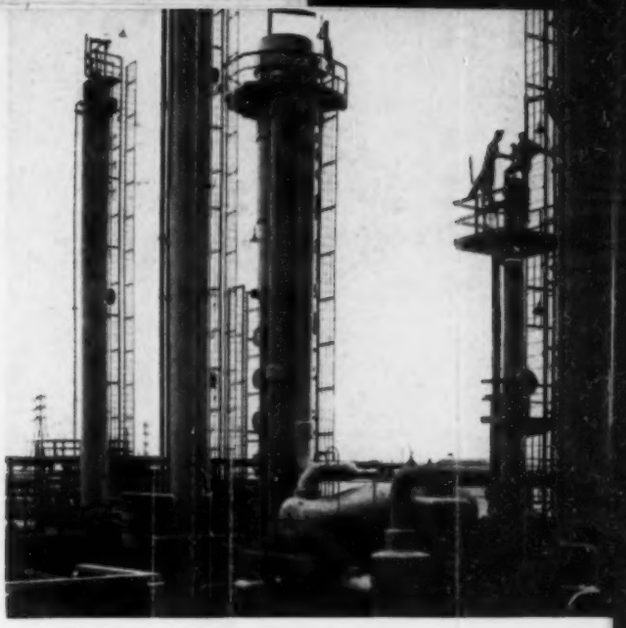
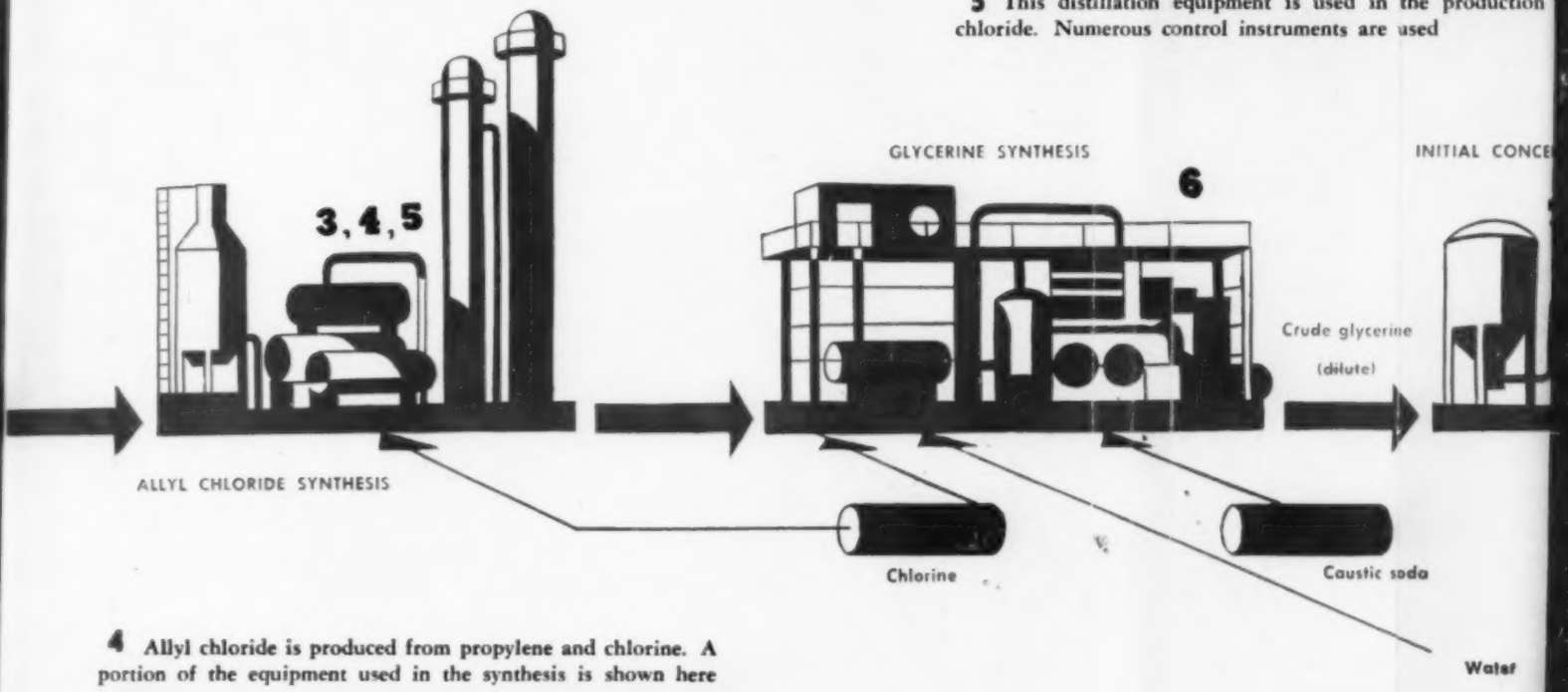


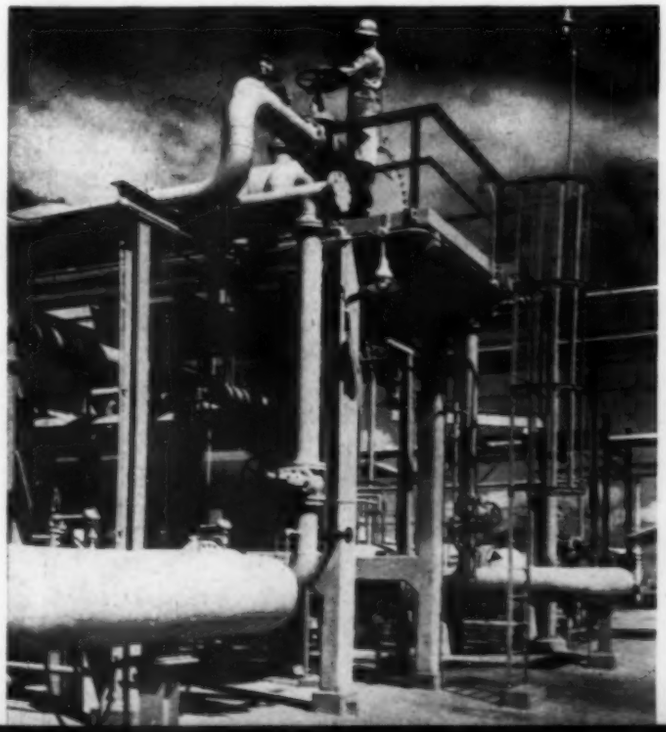
3 Propylene pressure is raised from 40 lb. to 260 lb. by this 1,000 hp. compressor in allyl chloride production



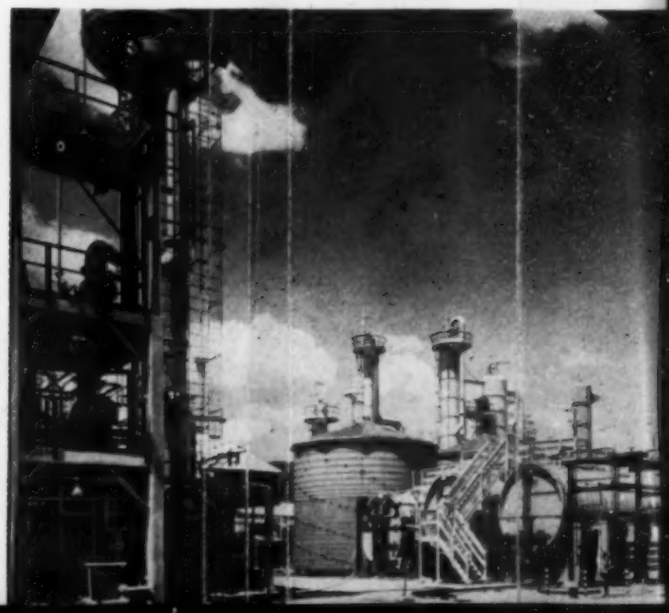
5 This distillation equipment is used in the production chloride. Numerous control instruments are used

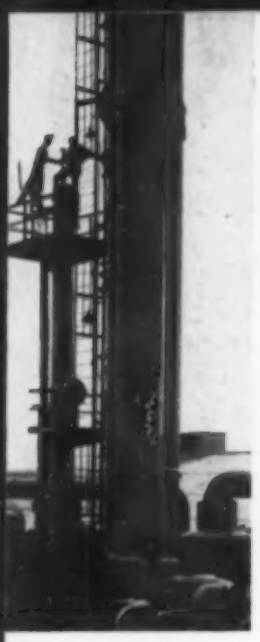


4 Allyl chloride is produced from propylene and chlorine. A portion of the equipment used in the synthesis is shown here

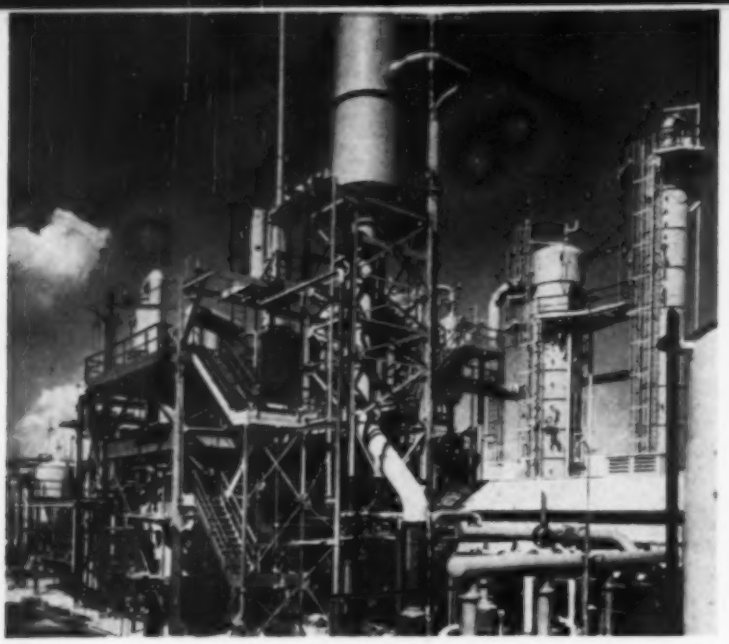


6 Dilute glycerine is synthesized in this unit of the Shell Che plant. The 60-ft. long wooden tanks are used for mixing vessels



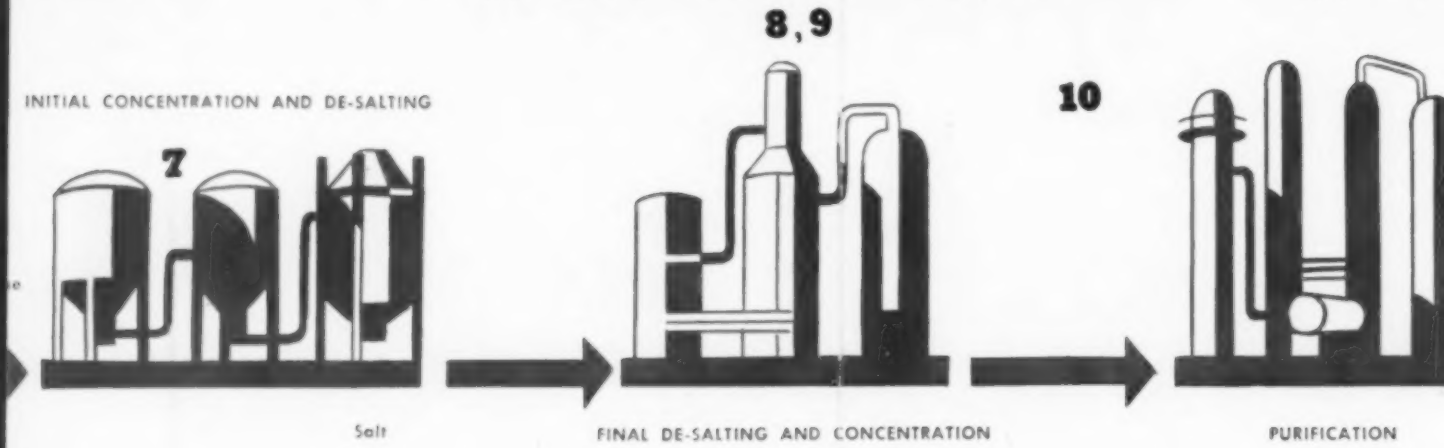


the production of allyl
used



7 Dilute glycerine is given initial concentration and desalting in this equipment in preparation of a semi-concentrated glycerine

9 After furth
equipment, pu

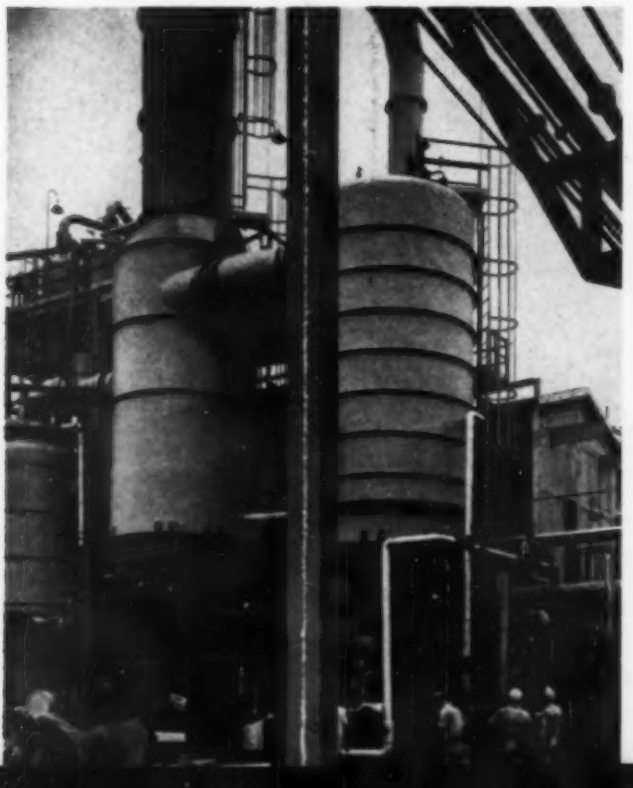


oda

Water

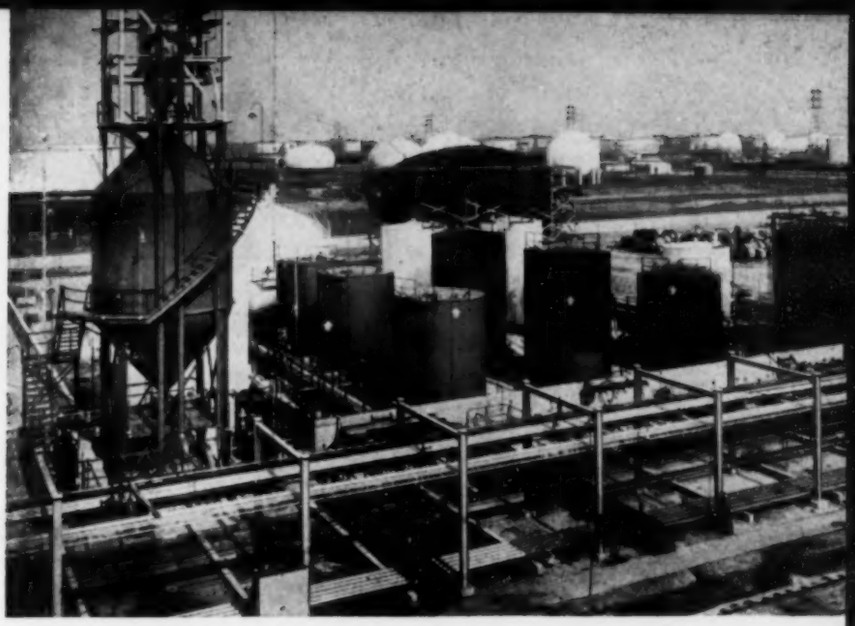
the Shell Chemical Co.'s Houston
mixing vessels

8 A final desalting and concentration in this vacuum equipment produces a more concentrated product

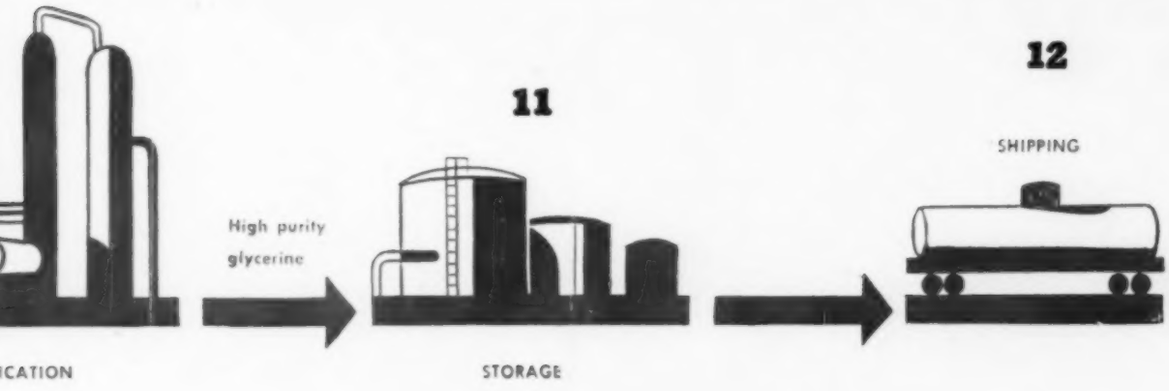


10 A final
produce the fi

After further concentration and distillation in nickel-clad uipment, purified finished glycerine is made

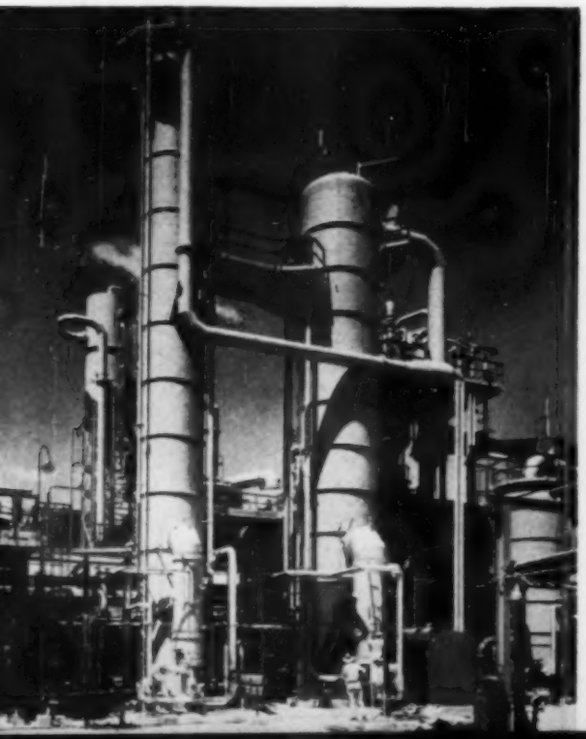


11 The finished synthetic glycerine is pumped to these nickel-clad steel storage tanks and held for shipment

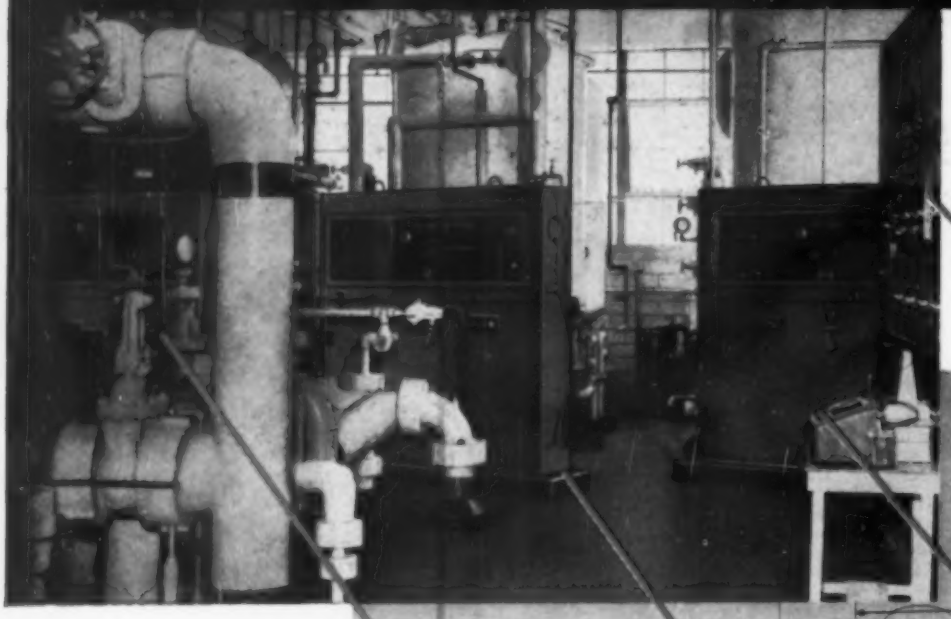


10 A final vacuum distillation is given the material to roduce the finished synthetic glycerine

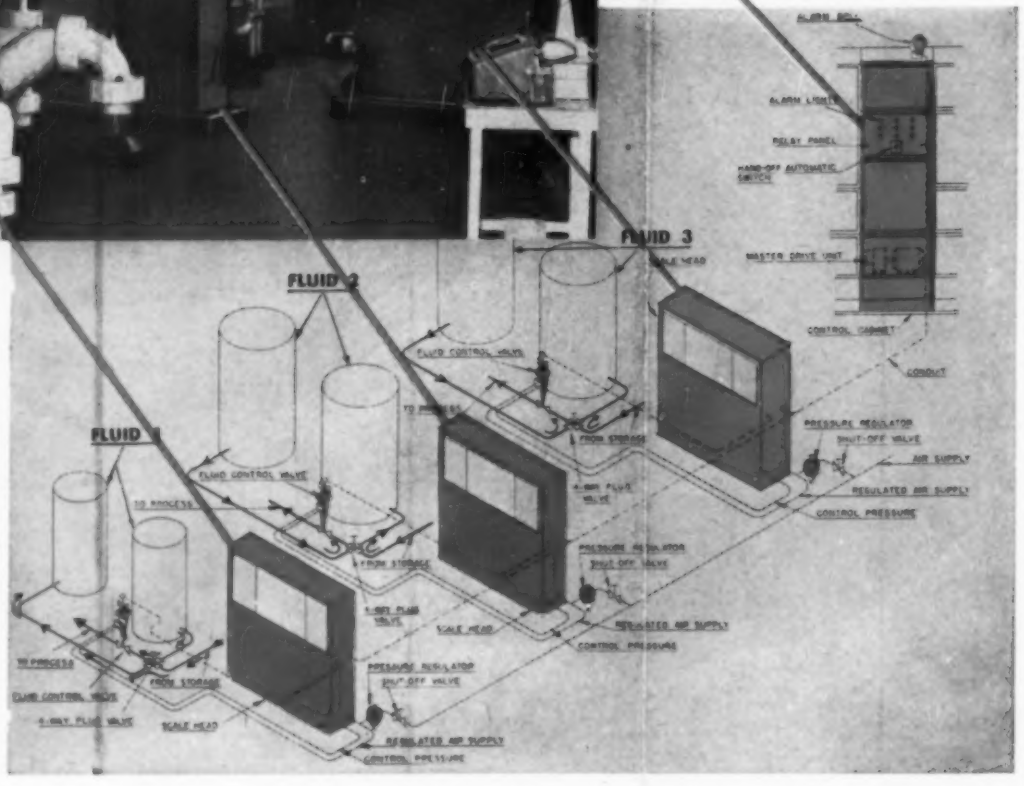
12 Synthetic glycerine is shipped in Fiberglas insulated aluminum tank cars which protect quality of product



HOW TO FEED *3 Fluids* IN PROPORTION AT ANY PRESET, ADJUSTABLE RATE



All equipment shown red in photo and flowgram furnished by %Proportioneers, Inc.%



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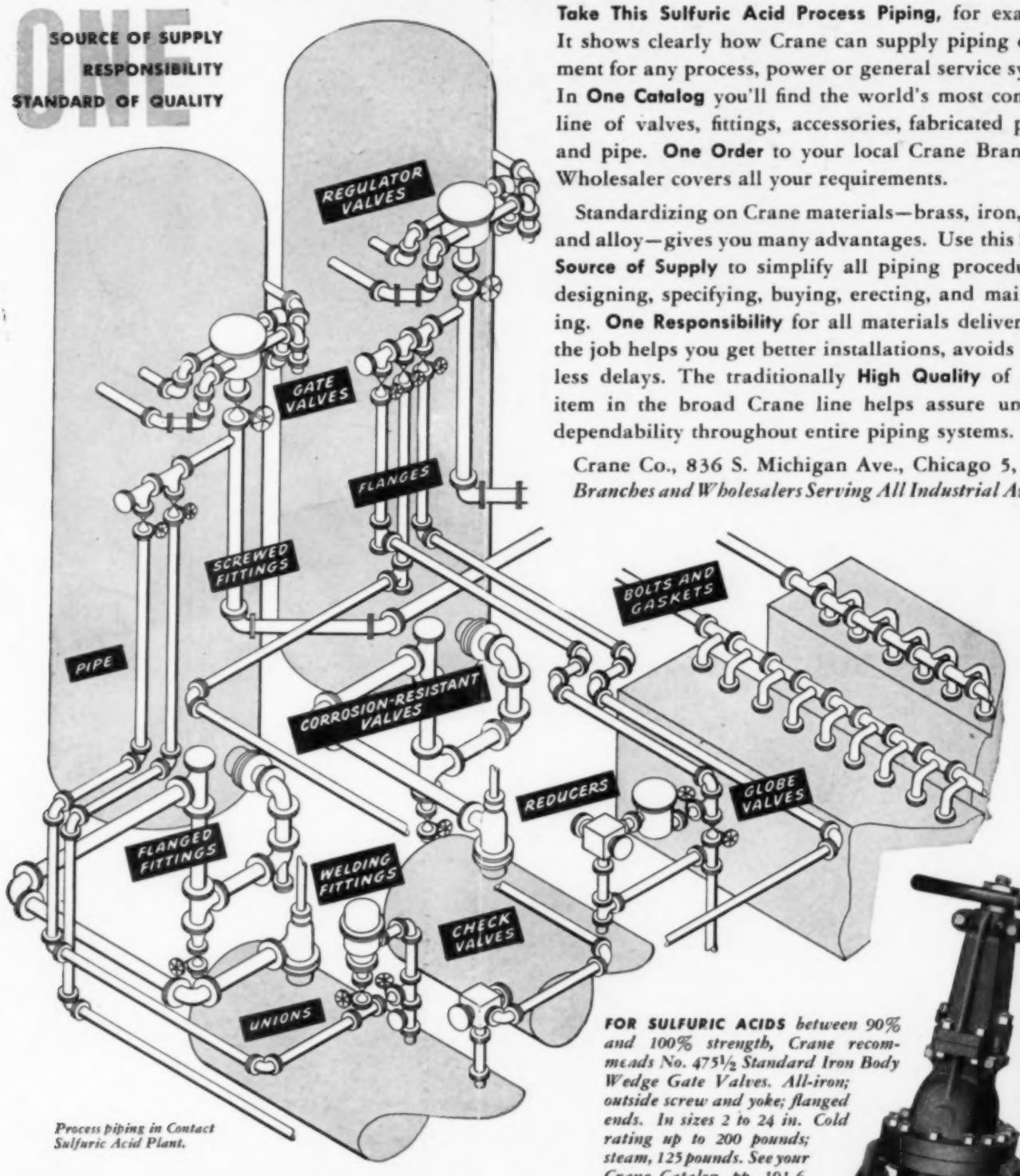

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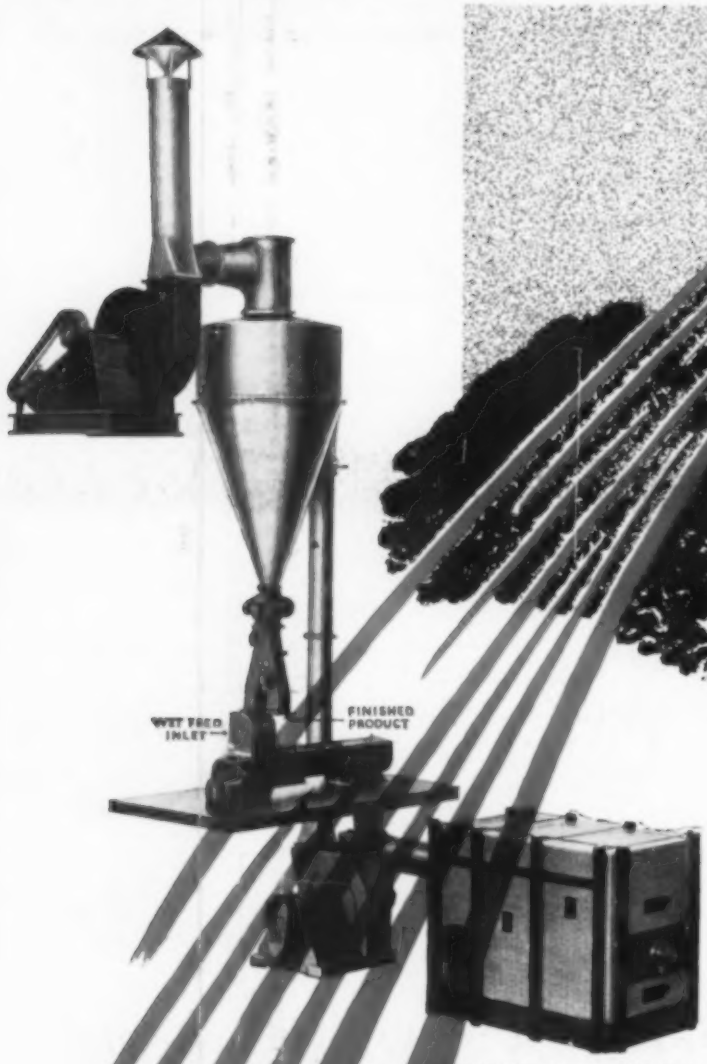

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PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

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FOR MORE INFORMATION
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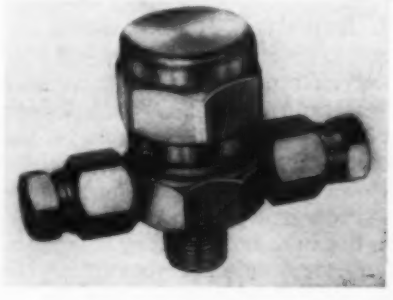
1. Gas Turbine Installation

WHAT is expected to be the first application of a mechanical drive combustion gas turbine in industry in the United States is about to be made on a natural gas line of the Mississippi River Fuel Corp., between Monroe, La., and St. Louis, Mo. The 2,000-hp. gas turbine is one which has already received over a thousand hours of test operation at the Westinghouse Turbine Division, Essington, Pa. Through cooperation of Westinghouse, Mississippi River Fuel, and Ingersoll-Rand Corp. a six months' trial of this turbine will begin early in 1949, driving an Ingersoll-Rand centrifugal compressor at 8,750 rpm.

The bedplate of this test unit is being modified to mount all components, including the compressor. Among the advantages expected are the following: The gas turbine produces more power per pound of weight than any other present-day power plant. It requires only a simple, inexpensive, concrete mat foundation and can be set up to operate in a few hours. It needs no water and very little lubricating oil. With few moving parts, maintenance problems are minimized.

The Westinghouse concern also has plans for building a gas turbine-powered locomotive.

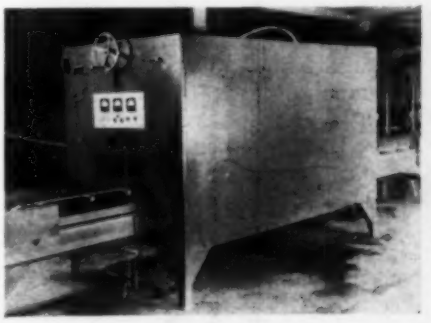


2. Lubricator Valve

FOR AUTOMATIC lubrication of up to 500 bearings or more, simultaneously and in less than a minute, employing either oil or grease, Titeflex, Inc., 523 Frelinghuysen Ave., Newark 5, N. J., has developed a new positive lubricator valve. Without alteration, the same valve can deliver any lubricant from light oil to heavy grease. It is completely inclosed to prevent leakage and operates hydraulically without pockets or crevices to retard lubrication. It is installed directly into the bearing and does not require special guns to introduce lubricant into the system. It will function with hand-operated guns or from a completely automatic system operated by time control.

3. Bronze Plug Valve

ALUMINUM BRONZE is the construction material of a new plug valve for process industries use, offered by Ampco Metals, Inc., 1745 South 38th St., Milwaukee 4, Wis. The valve may be provided in both non-lubricated and lubricated types. It is said to offer no resistance to flow when open, no turbulence, and to be self-cleaning and easy to operate. Sizes are from ¼ to 4 in., with any desired type of connection. A metal-protected Pyrex sight glass can be provided for inspection of the flow of liquid if desired, while in the 2-in. size pipe connections can be supplied for a flowmeter or gage. In the 3-in. size, both three-way and two-way types are produced.



4. Electronic Oven

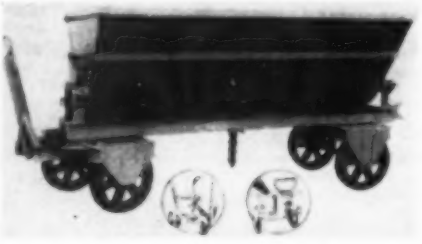
ALTHOUGH it was designed for the baking of foundry cores, the new dielectric conveyor type oven introduced by Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N. Y., should offer interesting possibilities

for other baking and drying purposes. For the particular case of core drying, for which data are available, it has been found that electronic heating times are in the order of 20 seconds to a few minutes, compared with minimum baking cycles in combustion ovens which generally run from one to four hours.

Green cores may be loaded directly on to the conveyor, with inspection of the finished product on the other end of the conveyor. Losses of product are stated to have been cut to less than 10 percent, compared with 30 to 40 percent by conventional methods. The new method makes use of resin binders. Since dielectric heating generates all the heat within the product being heated, virtually no heat is given off to the surrounding atmosphere, resulting in more comfortable working conditions. The unit illustrated is 16 ft. 9 in. long, 4 ft. 4 in. wide, and 6 ft. 8 in. high.

5. Self-Cleaning Filter

CONTINUOUS automatic operation, with a minimum of cloth area, is claimed for the new Autoclean dust filter developed by The Day Co., Minneapolis, Minn. The unit employs a number of filter tubes in parallel which are continuously and automatically cleaned by use of a slow-traveling, blow-back ring arrangement which directs high-pressure air through each cloth tube in the reverse direction. Maximum cloth area loss is only 1¼ percent, even when cleaning. No shutdown of any portion of the filter is necessary for cleaning or rapping at any time, so that constant back pressure and air volume are said to be assured. The dust and air travel in the same direction, so that the blow-back arrangement tends to blow the dust directly into the hopper. The unit requires minimum space and installation cost and is said to be rugged in construction and to require minimum maintenance. Any number of filter tubes in multiples of four can be secured.



6. Side-Dump Trailer

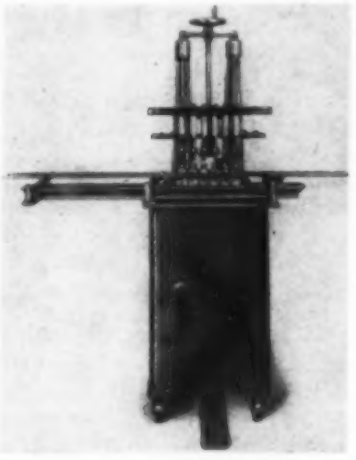
SHOWN in the accompanying view is a new side-dump trailer truck for hauling process and waste materials, currently offered by Palmer-Shile Co., 12606 Mansfield Ave., Detroit 27, Mich. The unit is equipped with gear type dumping rockers to provide easy operation and smooth action, and minimize wear. Dumping is controlled to either the right or left side, whichever is desired. An automatic coupler at the rear is standard equipment and permits use of this trailer in train hauling.

7. Unit Cooling Tower

FOR SMALL cooling tower requirements, for example, to handle up to 50 tons of refrigeration, the Marley Co., Kansas City 15, Kan., is offering a redesigned line of Aquatowers which are so compact as to be sent out completely assembled. The unit consists of a steel casing provided with nail-less redwood filling, completely assembled ready for operation as soon as piping and electrical connections are made. There are two general styles and seven sizes ranging from 3 to 50 tons of refrigeration. The unit employs forced draft, being provided with an aluminum fan with fan guard, and a motor. The basin is integral with the tower and may be reached from the front of the tower through an access door.

8. Pallet Retriever

A DEVICE which can be adapted for installation on any make of fork truck, for pushing loads from a pallet carried on the fork, is being offered by Hauser Machine Co., Fort Worth 11, Tex. A locking mechanism grips the pallet, while two powerful hydraulic cylinders exert a thrust of 4,000 lb. through a link system to a specially designed platen. In the retracted position the device occupies only 4½ in. of fork space, and can be extended to 42 in. in 15 seconds. A single electrical switch connected to the truck battery controls the whole sequence of operation. It is claimed by the manufacturer that in cases where a load is to be shipped without the pallet on which it was carried to the car, some 90 percent of car loading labor can be saved.



9. Vacuum Fillers

FOR semi-automatic packaging of liquids, the MRM Co., 191 Berry St., Brooklyn, N. Y., has introduced a line of four- and six-spout semi-automatic liquid vacuum fillers designed primarily for users requiring limited production on a variety of products and containers. The filler handles foamy or still liquids directly from a floor-level reservoir, and is designed to make cleaning and changeover a matter of minutes. Production capacities are 10 to 12 qt. per min., and 15 to 20 pints per min., with other sizes in proportion. The device will fill from 1 oz. to 1 qt. All contact parts are stainless steel.

10. Improved Instruments

SEVERAL new instruments are available from Henry A. Gardner Laboratories, 4723 Elm St., Bethesda 14, Md. Among these is the Interchemical wet film thickness gage for use in the paint and ceramic industries for determining the thickness of paint films or ceramic glazes. It is only necessary to roll this gage for a short distance over the wet coating, to determine its thickness with an accuracy of 0.1 mils. Another new instrument is the Hunter continuous recorder for gloss and reflectance. The instrument consists of one of the photoelectric exposure heads developed by R. S. Hunter, combined with a modified electronic recorder. The

5 REASONS WHY you get better values with Pfaudler Stainless Steel Equipment!

Process know-how—By specializing in the fabrication of chemical and food processing equipment for 65 years, Pfaudler has acquired process know-how that pays *you* dividends. It's the reason Pfaudler can offer suggestions which improve the process and increase yields.

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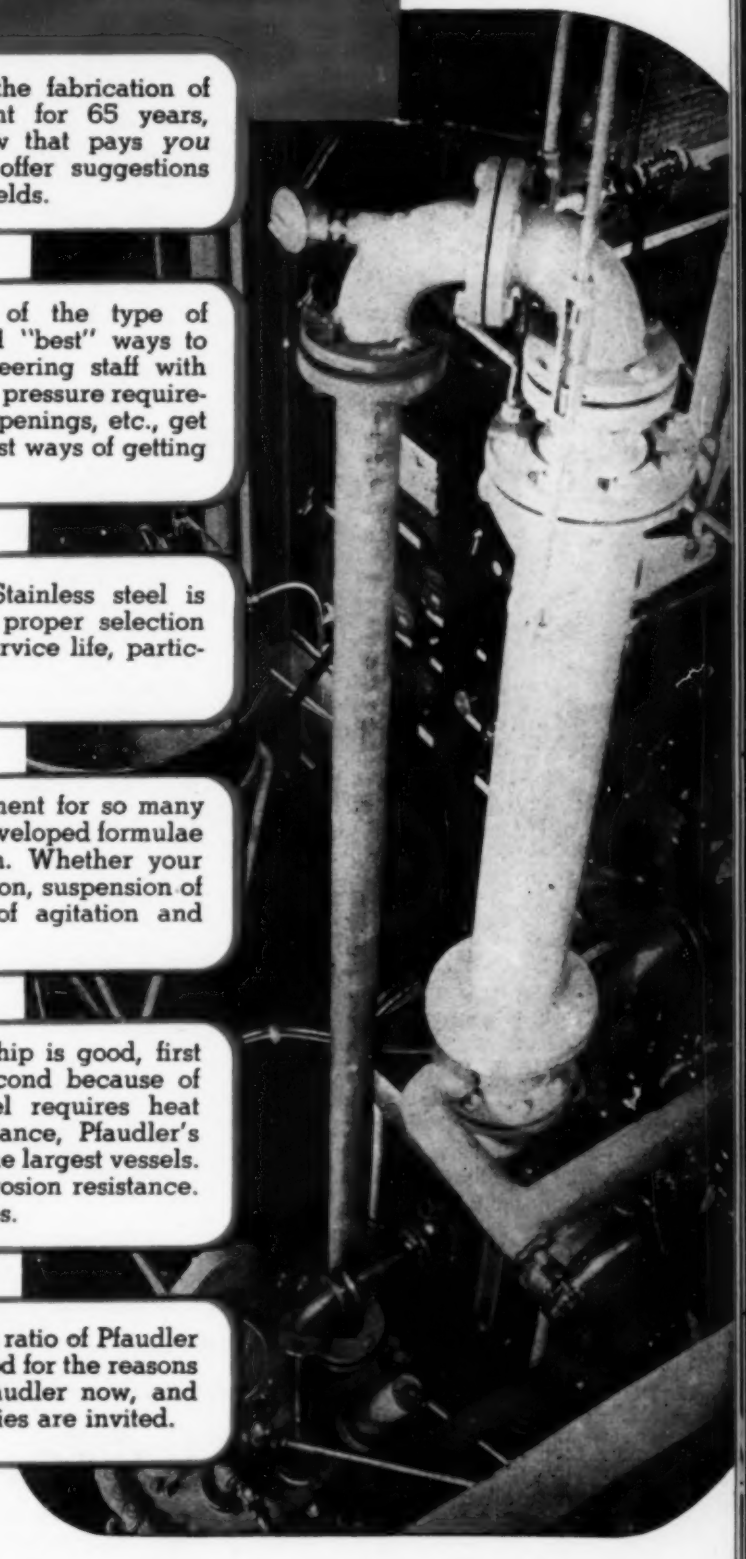
Engineered agitation—In building equipment for so many industries for so many years, Pfaudler has developed formulae which take the guesswork out of agitation. Whether your process involves gas absorption, emulsification, suspension of solids, etc., Pfaudler specifies the type of agitation and drive that does the job right.

Well equipped shops—Pfaudler workmanship is good, first because of experienced workmen, and second because of well-equipped shops. When stainless steel requires heat treatment to secure better corrosion resistance, Pfaudler's automatically controlled furnaces will take the largest vessels. Passivation is also helpful in improving corrosion resistance. Here again, Pfaudler has the proper facilities.

Summing Up—Users tell us that the life-cost ratio of Pfaudler stainless steel equipment is exceptionally good for the reasons given above. Place your business with Pfaudler now, and prompt deliveries can be made. Your inquiries are invited.



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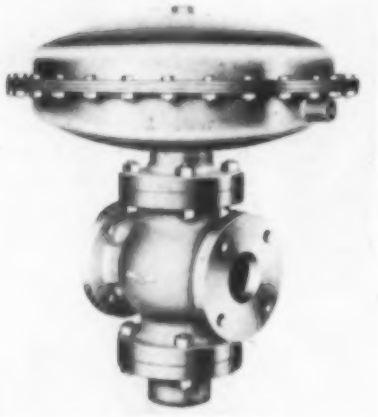
instrument automatically calibrates itself at 15-min. intervals. It can be combined, if desired, with usual types of controlling valves and switches. Still another instrument is the Hunter color and color-difference meter which can be adjusted to give instrument settings corresponding to visual perceptions of color. It is claimed the new apparatus has higher precision for color differences than any other instrument heretofore available.



11. Diaphragm Control Valve

ELIMINATING the use of both springs and stuffing boxes, the Hammel-Dahl Co., 243 Richmond St., Providence 3, R. I., has introduced its new 4,000 series pressure-loaded diaphragm control valve. The fluid pressure from the outlet side of the valve body is applied to the under side of a large area diaphragm. Loading pressure from a remote operator or air-operated instrument is applied to the upper side of the diaphragm in the usual way. Thus, there is no need for either springs or stuffing box, and the action of the valve is claimed to be almost frictionless, without hysteresis. Common applications are back-pressure and reducing service, as well as rate-of-flow control. Top- and bottom-guided parabolic plugs are standard construction. Valve bodies can be supplied in either cast iron or cast steel, with diaphragm cases in steel construction only. Type 304 stainless is standard for trim, although other trim materials may be provided. Diaphragms are of neoprene, with fabric insertions. Valve sizes range from ½ to 12 in.

12. Compressor Check Valve

AS AN improvement over the customary arrangement of using a globe and safety valve in the discharge line of air compressors, the Pennsylvania Pump & Compressor Co., Easton, Pa., has announced its new Aircheck valve which is automatic in operation and prevents discharge of air or gas in the line back through the compressor during an off cycle. Construction is similar to that of the company's Air Cushion valve employed in compressors, which is said to prevent hammer of the parts and to contribute to quiet operation. The unit is self-contained and automatic in operation, and is so designed that it cannot be assembled incorrectly. The valve contains two annular ports which are normally closed by valve plates under spring pressure, but offer virtually no resistance to flow in the proper direction.

13. Temperature Controller

FOR A variety of steam heating applications, the Sarco Co., 350 Fifth Ave., New York 1, N. Y., has introduced a combination temperature regulator consisting of a temperature controller of the electric contact-making type, combined with a pilot-operated flow control valve. The pilot of the latter is controlled by the contact-making mechanism and admits steam pressure to the under side of the control diaphragm to regulate the main valve. The set-up features indication of the control temperature, and ready adjustment of the control point.

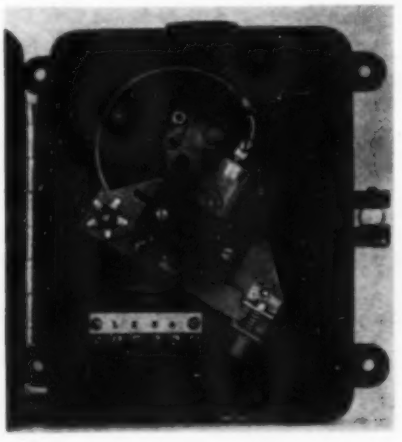
14. Level Gage

FOR GAGING the liquid content of tanks at pressures of 10,000 psi. and higher, the Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass., has introduced a new high-pressure gage that has been tested to 20,000 psi. As the illustration indicates, the gage is of unusual construction. The chamber and covers are machined from bar steel stock, and the covers have a series of ½-in. ports through which the liquid level is viewed. The glass is 11/16 in. thick tempered Pyrex and ring gaskets confine the pressure on the glass to the area of ½ in. diameter circles. The gage is built in various lengths up to about 6 ft., and is available in a variety of steels and special metals to meet whatever conditions must be contained.

15. Stainless Piping

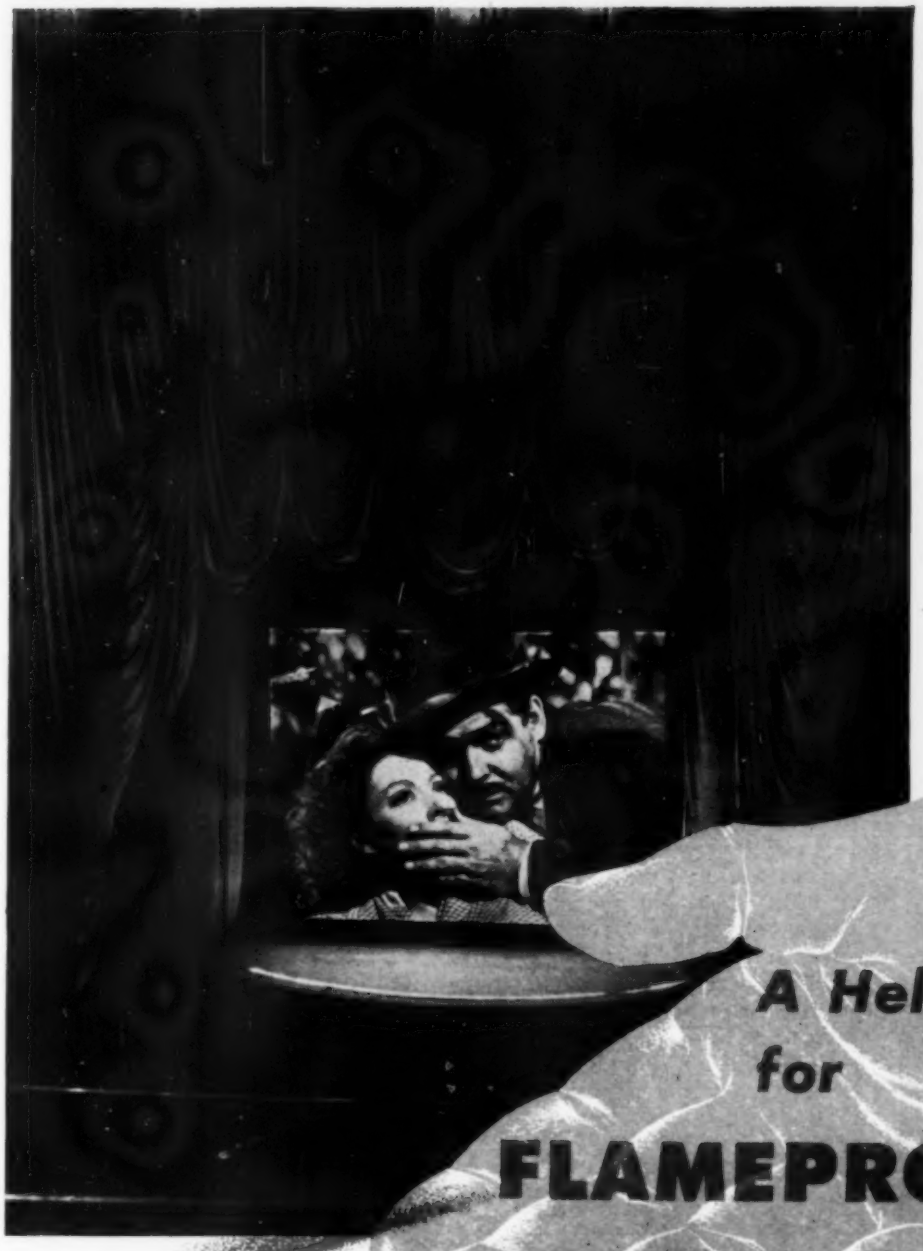
INCREASE in the use of stainless steel piping in chemical processing plants is anticipated as a result of a new method of joining light weight stainless steel piping and fittings, developed by the H. K. Ferguson Co., Cleveland, Ohio. The new method eliminates the need for welded joints by combining a new type light-wall stainless steel Vanstone-end fitting, with light-wall stainless tubing which can be cold-Vanstoned in the field. The fitting and pipe are then bolted together by means of carbon steel split-type back-up flanges. Fittings are now available for 125-lb. pattern dimensions, and it is necessary only to Vanstone the tubing in the field. A portable machine has been developed for this purpose.

Tests are said to have shown that the cold working of the pipe does not produce extreme work hardening, nor does it open the joint to corrosive attack. As compared with welded systems, there is no fire hazard during installation. The new system is sometimes more costly, but it is claimed that eventual cost is lower due to reduced maintenance and replacement cost.



16. Motion Transmitter

A VIRTUALLY frictionless device for converting the movement of instrument sensitive devices into electrical indications has been introduced under



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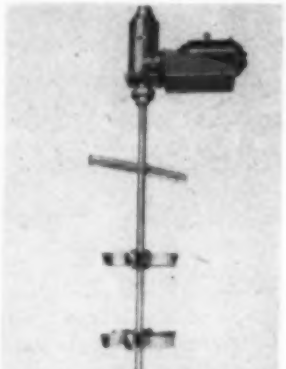
2856 Eighth Avenue New York 30, N. Y.

the name of Atcotran by the Automatic Temperature Control Co., 5212 Pulaski Ave., Philadelphia 44, Pa. This device can be applied to instruments for indicating, recording and controlling pressure, vacuum, flow, level, density, weight, temperature, humidity, thickness and other variables. The device consists of a group of three coils wound on a single spool, with a light, frictionless, free-moving armature of magnetic material inside the spool. Little or no reaction force, it is claimed, is exerted on the transmitting device.

When motion is transmitted to the armature by a sensitive device, such as bourdon tube of a pressure gage, it is claimed that a practically perfect response of the sensitive element is obtained because it is not loaded with instrumentation gear and thus hysteresis and other undesirable effects are claimed to approach the vanishing point. When the three coils are connected in the proper fashion, with ordinary a.c. applied to the center coil, and the outer coils connected to the indicating instrument, the induced output to the instrument varies directly with the position of the armature and thus gives a linear electrical response to linear mechanical motion. A wide variety of arrangements of single or multiple Atcotrans is possible, either with or without use of electronic amplification, for transmission of practically any kind of indication. The accompanying illustration shows a bourdon tube type indicating pressure gage transmitter.



17. Improved Turbine Agitator

FOR HANDLING suspended materials in relatively high viscosity solutions, and for dissolving viscous solutions up to approximately 100,000 c.p., Industrial Process Engineers, 5200 Hudson Ave., West New York, N. J., has announced an improved turbine agitator. As the accompanying illustration shows, the new turbine combines features of the pitched blade and curved blade types, to provide for both axial and radial flow characteristics in one unit. The agitator can be built either with a step bearing where conditions permit, or, when it is undesirable to have bearings in the tank, with cantilever support for external bearings.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 157-158

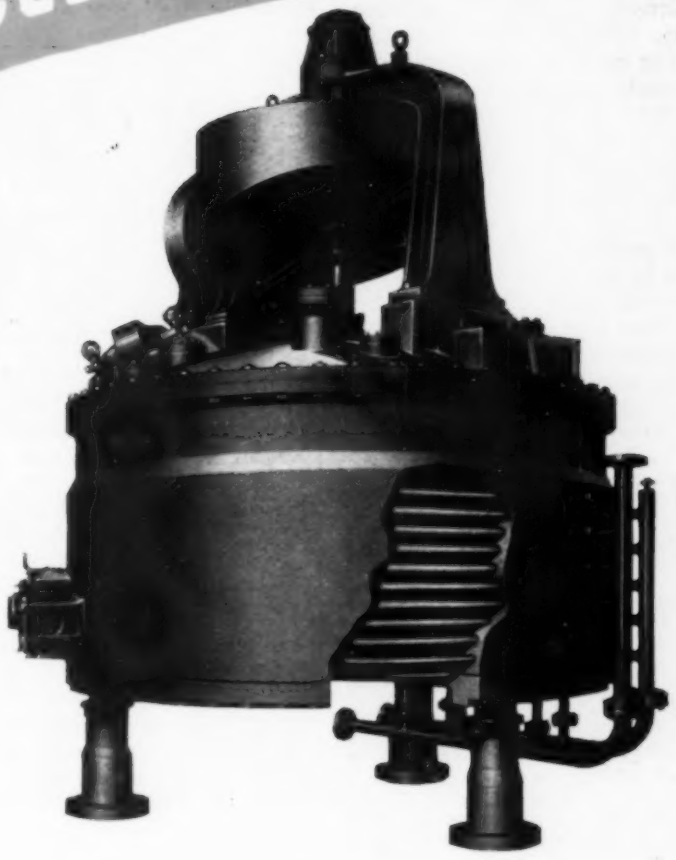
18. Portable Pump

PUMPING capacity of 60 gpm. at 90 psi. pressure or 150 gpm. at 30 psi. is provided by a new self-powered centrifugal pumping unit designated as Model FZZ which is being produced by the Hale Fire Pump Co., Conshohocken, Pa. The unit is small in size and is available either with hand-carrying frame or a barrow type carriage with pneumatic tires for portability. The unit may also be used on a stationary mounting. The single-stage centrifugal pump is powered by 7.7-hp. air-cooled Briggs & Stratton gasoline engine. An automatic priming system is provided.

19. Carboy Truck

FOR GREATER safety in the handling of carboys, the Palmer-Shile Co., 12606 Mansfield Ave., Detroit 27, Mich., has developed a truck which picks up the carboy automatically, prevents heavy lifting, and eliminates any possibility of dropping the carboy. The truck is similar to a standard two-wheel truck, except that it is provided with sharp steel studs which grip the load to prevent slipping. It is also equipped with a gripping yoke which, when the truck is tilted back, lifts the load automatically. To unload, it is

PROCESSING EQUIPMENT



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In addition, Bethlehem facilities stand ready to produce kettles, high pressure autoclaves, heat exchangers, dryers, or any of a number of units you may need . . . built to your exact specifications. Bethlehem has specialized in the engineering and building of specialized chemical processing equipment for many years. The technical "know-how" of our engineering staff will prove of outstanding value to you in solving your processing equipment problems. For more details on the many facilities of Bethlehem write for our complete engineering catalog.

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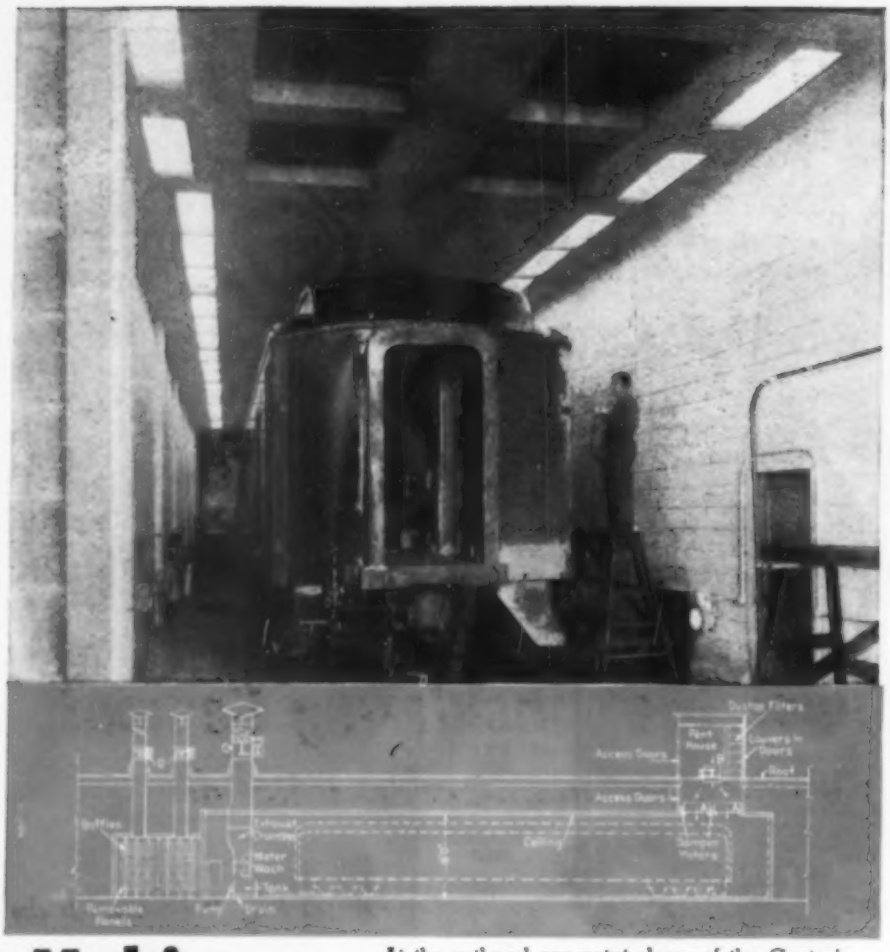


Making a Paint Shop "Breathe"

At the railroad car paint shops of the Central Railroad of New Jersey at Elizabethport, N. J., fresh air supply, and exhaust of contaminated air are accomplished by means of Wing Straight Line Duct Fans, while the temperature of the air is controlled by means of Wing Variable Temperature Heater Sections.

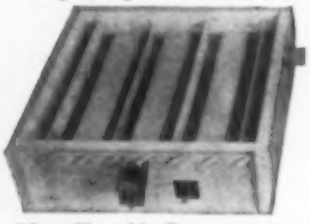
Two 7½ hp. Wing Straight Line Duct Fans, mounted in a penthouse at the open end of the paint spray shop, supply filtered fresh air at the rate of 45,000 cu. ft. per min. through 4 Wing Variable Temperature Heater Sections, which permit any temperature variation desired.

At the other end of the shop, the contaminated air is thoroughly washed by being drawn through a water curtain by two 15 hp. Wing Straight Line Duct Fans, installed in stacks above the roof, where it is exhausted to atmosphere.

Two 3 hp. Wing Straight Line Duct Fans are also installed in a small parts spray booth.

Reprint of an article describing this installation is available. Write for a copy today.

Wing Straight Line Duct Fan



Wing Variable Temperature Heater Section

L. J. Wing Mfg. Co. 170 W. 14th Street, New York 11, N. Y., Factories: Newark, N. J., Montreal, Can.

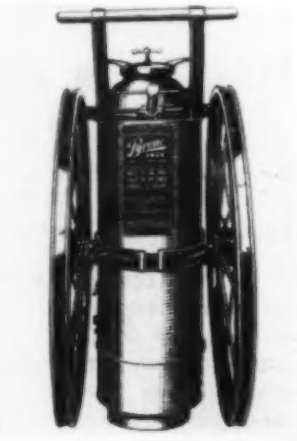
Wing

VENTILATING FANS

only necessary to tip the truck forward and release the gripping yoke. The truck has a capacity of 500 lb., is equipped with roller-bearing wheels, and may be provided with rubber, pneumatic, or metal tires.

20. Hand Truck Attachment

ANY TWO-WHEELED hand truck can readily be converted into a well-balanced three-wheeled truck through the use of a tilt truck attachment offered by the Melooz Mfg. Co., 4730 Avalon Blvd., Los Angeles 11, Calif. A telescoping tube, extending upward from the platform to the top cross piece of the truck, is adjustable by finger-tip control so that the truck can be tilted and locked at any angle desired. A leverage plate extending over the third wheel brings the trucker away from, and out from under the load when breaking, preventing injuries. The use of this device is said to remove all strain from the trucker and to eliminate the possibility of load damage and personal injury.



21. New Foam Engine

DELIVERY of 375 to 400 gal. of foam in 5½ minutes is claimed for a new wheeled 40-gal. foam engine for fighting flammable liquid fires, put on the market recently by the Pyrene Mfg. Co., Newark, N. J. This foam delivery is said to be 50 percent greater than that of the 40-gal. Phomene extinguisher which this new engine re-

Temperature control demands

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"Springy Ball" pellets of Eagle-Picher Mineral Wool give Super "66" tremendous insulating efficiency. Each pellet contains heat-saving dead air cells that remain after the insulation dries to preserve *permanent* low thermal conductivity. In addition, Super "66" actively inhibits rust on metal equipment. It's all-purpose, sticks to any shape surface, and withstands temperatures up to 1800 F. Complete technical and application data on request.

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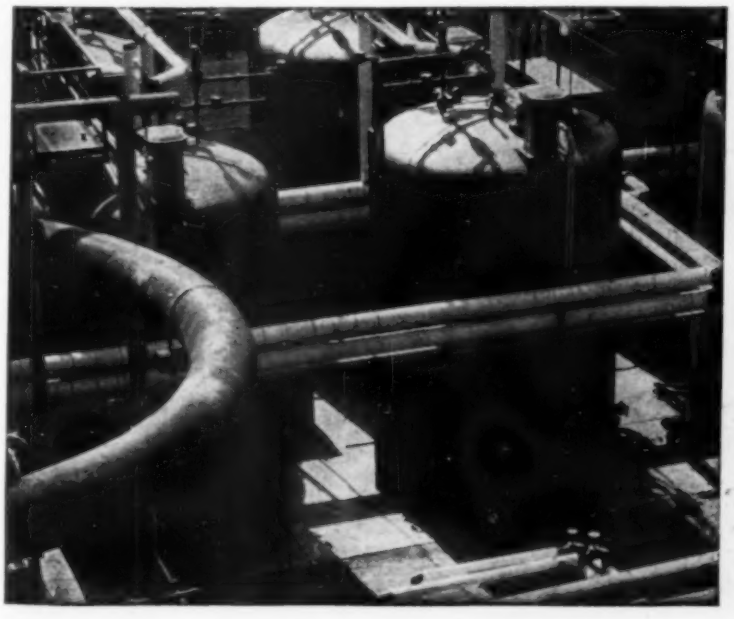
Insulating Cements



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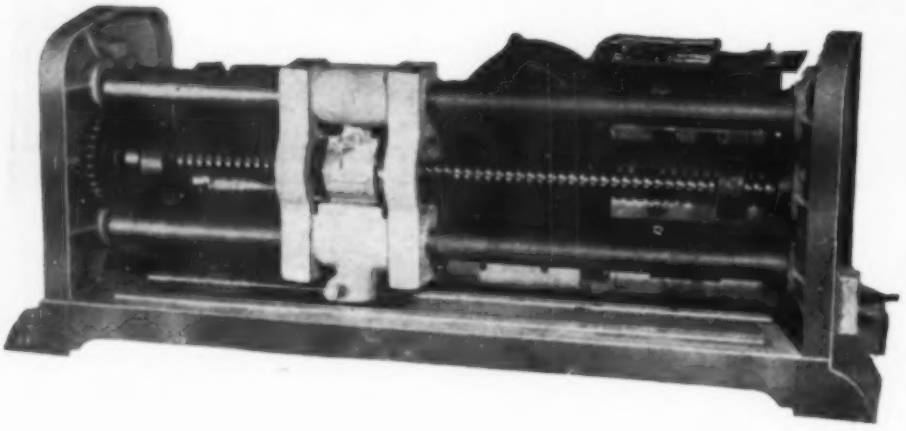
has wide range of adaptability



The GEARY-JENNINGS SAMPLER is being successfully applied to many products in a wide range of industries, handles either wet or dry materials and can be adapted to sampling of corrosive solutions. Ore, mill pulp, scrap metal, corn grits, malt, coal, potash, textiles, cement and phosphates are a few of the wide range of materials being accurately and profitably sampled by GEARY-JENNINGS.

The GEARY-JENNINGS SAMPLER is ruggedly built, compact machine — self contained — easily installed and requires only small space and minimum of head room.

Write us for full detail on how the GEARY-JENNINGS SAMPLER can be specifically and readily adapted to your sampling problems. Inquiries promptly and fully answered.

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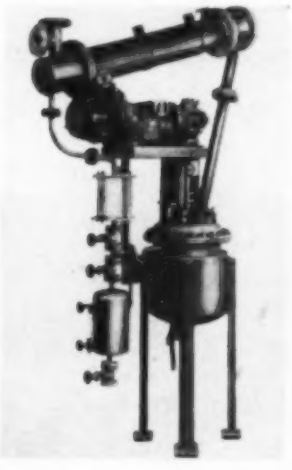
FOR MORE INFORMATION
See Reader Service Coupon on pages 157-158

places. The new foam is said to be stiffer, to last longer, and to perform more efficiently against flame. The foam stream has a range of 40 to 55 ft. Improved performance is obtained through redesign of the extinguisher which alters the rate of chemical action, plus the use of an improved foam stabilizer in the chemical charge. The new engine is designated as the Pyrene Foam Fire Extinguisher, to distinguish it from the earlier Phomene extinguisher.

22. Duct Lining Material

AFTER several years of continuous tests, the Ceilcote Co., Cleveland, Ohio, has introduced Ceilcote Spray Grade, a lining material for fume-carrying ducts, which is both acid- and alkali-proof. Maximum service temperature is 300 deg. F. The material bonds to either wood or metal and is applied by special spray equipment which builds up linings to ¼ in. thickness, to provide for expansion and absorption, and eliminate cracking from vibration.



23. Pilot Plant Kettle

DESIGNED for full vacuum operation throughout, a new special stainless steel pilot plant kettle for handling liquid and semi-liquid compounds is being offered by L. O. Koven & Brother, Inc., 154 Ogden Ave., Jersey City 7, N. J. The kettle is jacketed for heating by 125 psi. steam or 250 psi. hot water. A six-to-one range in agitating speed can be obtained with

A useful guide to better results with Stainless

Here in convenient form we have condensed the essential facts about the various grades of U·S·S Stainless Steel that will assist you in determining broadly which is most suitable for your needs. Keep in mind, however, that this chart merely indicates general characteristics and basic applications.

To get *optimum* results from these service-tested Stainless Steels, any fabricator, and especially any one contemplating the use of Stainless for a new product, should obtain expert advice in its selection and fabrication. This we are prepared to furnish.

Our Stainless engineers are specialists in the use of these materials. Ask for their cooperation. You'll find their suggestions practical and extremely helpful not only in determining the grade of U·S·S Stainless that will do the best job for you, but in showing how it can be handled most efficiently on your equipment.

15 types of U·S·S Stainless Steel to choose from

	grade	characteristics	when or why used
austenitic	U·S·S 18-8 Type 302	Excellent corrosion resistance.	General all-purpose grade for food, dairy, chemical, and architectural uses.
austenitic	U·S·S 18-8 S Type 304	Carbon is limited to 0.08% maximum.	For applications similar to U·S·S 18-8 Type 302, but offers superior corrosion resistance in weld-affected areas.
austenitic	U·S·S 18-8 Ti Type 321 U·S·S 18-8 Cb Type 347	Similar in general corrosion resistance to U·S·S 18-8 and U·S·S 18-8 S. Stabilizing additions immunize corrosion attack of heat-affected areas.	High temperature service, 800°F to 1600°F. For severe corrosion conditions in welded assemblies which cannot be subsequently annealed.
austenitic	U·S·S 18-8 Mo Type 316	Exceptional corrosion resistance, improved creep strength.	Severe corrosive conditions, particularly those involving pit-type corrosion.
austenitic	U·S·S 18-8 FM Type 303	Galling and seizing reduced, machining greatly improved.	Gears, valves, bolts, screws, or other machined products.
austenitic	U·S·S 25-12 Type 309	Exceptionally stress resistant at high temperature exposure.	In service where temperatures up to 1900°F are encountered.
austenitic	U·S·S 25-20 Type 310	Offers superior resistance to oxidation.	Applied where very high temperatures are involved.
ferritic	U·S·S 17 Type 430	Good corrosion resistance.	Automotive and interior architectural trim; some specific chemical applications.
ferritic	U·S·S 27 Type 446	Limited formability, generally not adapted to severe drawing. Excellent scaling resistance.	Principally used at high temperatures up to 2000°F for static parts not subjected to high stress.
ferritic	U·S·S 12 Type 410	Martensitic grade, strengthened by conventional heating and quenching.	Engaging mechanical parts, such as pump rods and valves.
ferritic	U·S·S 12 Turbine Type 403	Composition basically same as U·S·S 12.	Modified analysis suited for turbine blades and similar application.
ferritic	U·S·S 12 AL Type 405	Composition basically same as U·S·S 12.	Modified analysis for applications requiring field welding where air-hardening cannot be corrected by heat treatment.
ferritic	U·S·S 12 FM	Added elements give extra machinability over U·S·S 12.	Used for valve parts and other articles made on automatic machines.
ferritic	U·S·S 5 Type 501	Welding hardens; annealing restores ductility.	Used in petroleum industries for strength, and resistance to corrosion and oxidation at moderately high temperatures.
ferritic	U·S·S 5 S Type 502	Basically same as regular U·S·S 5.	Modified analysis reduces tendency to weld-harden.

forms available

SHEETS are supplied in plain or polished finishes which are standardized. They are designated as: No. 1—Hot Rolled, Annealed, and Pickled; No. 2D—Dull Cold Rolled; No. 2B—Bright Cold Rolled; No. 4—Standard Polish on either One or Both Sides; No. 6—Tampico Brushed; No. 7—High Luster Polished.

STRIP is supplied to ordered requirement in coils or straightened and cut lengths. It should be ordered to a decimal thickness, with width and finish to suit the particular application.

PLATES AND BARS are furnished hot rolled, annealed, and pickled; bars are also furnished cold finished, centerless ground, or polished. Special sections and plates are furnished with pickle finish and require coarse abrasives in preliminary grinding, where a polish is desired.

TUBULAR PRODUCTS are furnished in most popular grades of U·S·S Stainless Steel. A variety of finishes are obtained by grinding and polishing cold drawn, annealed, and pickled tubing.

ROUND WIRE is available in coils within a size range of .5" to .005" inclusive. Straightened and cut material is limited to .030" and coarser. Finishes available include pickled, metallic coated, oil, diamond, and soap drawn, ground, and polished. A variety of cold heading wire, spring wire, weaving wire, armature binding wire, and wire rope are also available in stainless steels.

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CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
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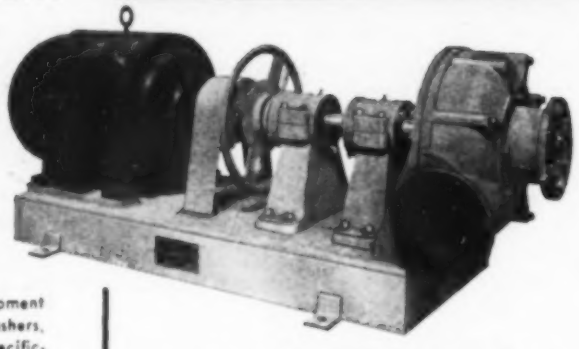

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Above facility adapts the Attrition principle to a very special operation requiring the return into solution of small globules and semi-solids present in certain viscous fluids. Standard types of this Attrition Mill available in all sizes and various production capacities. Data sheets, details and prices upon request. Inquiries invited!

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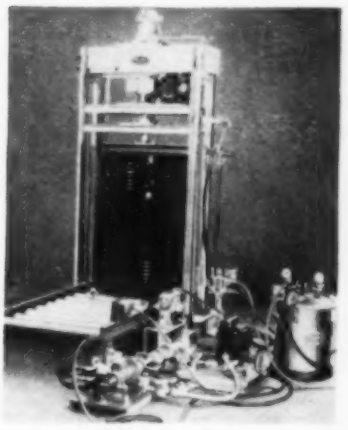
the master speed control. A U-type agitator is provided to stir and remove material from the sides and bottom of the kettle. The vacuum-tight cover carries two sight glasses, a thermometer well, and a large hand hole. A welded stainless steel condenser discharges condensate to a vacuum receiver, or refluxes any desired portion of it. A 7-in. valve in the bottom of the kettle is provided for easy removal of the contents.



24. Chime Painter

PAINTING of steel drums can be stepped up to more than 400 per hour with a new automatic spray painter for steel drum chimes offered by Eclipse Air Brush Co., 418 Park Ave., Newark 7, N. J. The machine employs two low-pressure spray guns to reduce offspray and thus save paint. The operation of painting the chimes or striping is entirely automatic, including positioning of the drum, spraying, and discharge of the finished job.

Equipment Briefs

25. TO COMBINE maximum belt strength with maximum open area, the Cambridge Wire Cloth Co., Cambridge, Md., has introduced the new Twistex woven wire conveyor belt for use in industrial washing, drying, treating or cooling machines. The mesh size can be controlled to provide up to 87 percent open area, while the novel coil construction is said to utilize the maximum strength of the metal from which the belt is made. Many metals and alloys can be employed in fabricating such belting.

26. SNAP-ON flexible tubing couplings, which are interchangeable on various nipples, have been introduced by the Ronaflex Tubing Co., Packard Bldg., Philadelphia 2, Pa. For example, the $\frac{3}{8}$-in. size fits $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$-in. nipples, while the $\frac{1}{4}$ and $\frac{1}{2}$-in. sizes will also fit

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Less than twelve months ago General Chemical Research introduced SULFAN—Stabilized Sulfuric Anhydride—to the Process Industries. Even in that short space of time, many using SULFAN have predicted it may well "rewrite the book on sulfonation and sulfation!"

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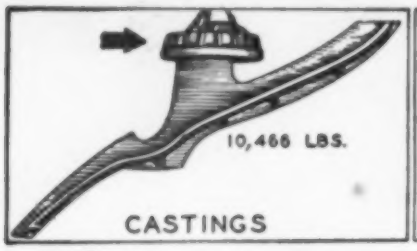

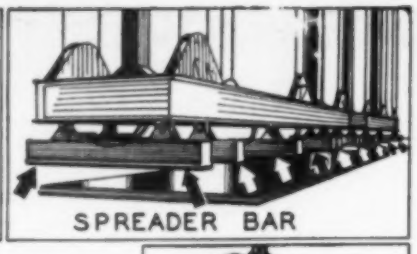

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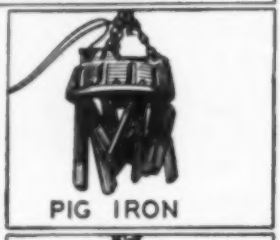
Will speed your loading and unloading operations—obviate hand labor on dangerous and difficult jobs—increase storage capacities—reduce your costs.

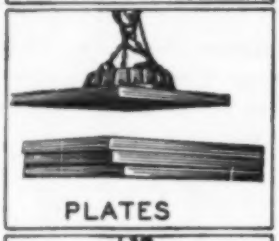
Let Stearns give you a lift with sturdy, dependable, low initial and operating cost magnets. Can be had in all practical sizes and shapes to suit your requirements.

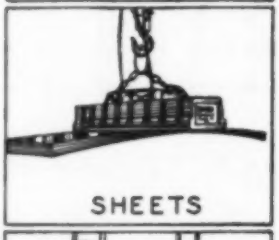
Stearns Magnets are being successfully and profitably used in handling scrap iron, loose or baled; steel plates, coils, bundles, strips; rails, slabs, billets, pig iron, castings, borings, turnings, finished products, etc., as well as for road and floor sweeping purposes. Can be installed on industrial crane trucks for out of the way spots not reached by overhead cranes.

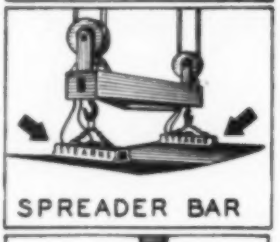
Stearns Magnets pay for themselves in a short time, require surprising little attention, are your best bets for economical, fast and safe moving of material.

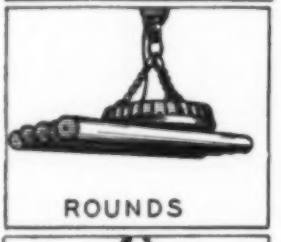
And—we can furnish Suspended Separation Magnets also in sizes and shapes to do your work.











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all three sizes. The degree of interchangeability varies with the type of coupling and the size. In any event, a limited number of sizes will fit a wide variety of nipple sizes, so that fewer sizes need be stocked.

27. To make certain that a flashlight can be found readily in event of an emergency, the electrical division of Olin Industries Inc., New Haven, Conn., has developed a luminous-case Winchester flashlight. The entire case is coated with a harmless luminous material baked on to the solid drawn brass case. This is coated with a clear plastic protective covering, insuring long wear without harm to the finish. Exposure to any light for 5 seconds or less is sufficient to activate the luminous material.

28. For the sensitive metering of fluids and gases, the Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio, has introduced a specially designed needle valve with a long 10-deg. included-angle tapered needle and 40 stem threads per inch. The valve is regularly produced in high strength brass, but can be had with aluminum alloy bodies. Sizes are $\frac{1}{4}$ and $\frac{1}{2}$ in.

29. Designed especially for sensitive temperature measurements, pH measurements, null detection in bridges, and similar purposes, a vacuum-tube voltmeter having a maximum sensitivity of 1 millivolt at full scale has been introduced by Millivac Instruments, P.O. Box 3027, New Haven, Conn. The meter can safely be overloaded 100,000 times and can read up to 1,000 volts in 13 ranges. The operating principle is said to differ markedly from that of other vacuum-tube meters.

30. A product known as Corodex Coil Clean has been introduced by Allied Products Co., 1133 Newport Ave., Chicago 13, Ill., for removing lime and mineral scale from heat transfer surfaces. It is only necessary to bring the liquid in contact with the scale, whereupon foaming starts. When foaming stops the unit is said to be clean. The material is claimed to be non-explosive, non-flammable, and non-injurious to metal or the hands of the user.

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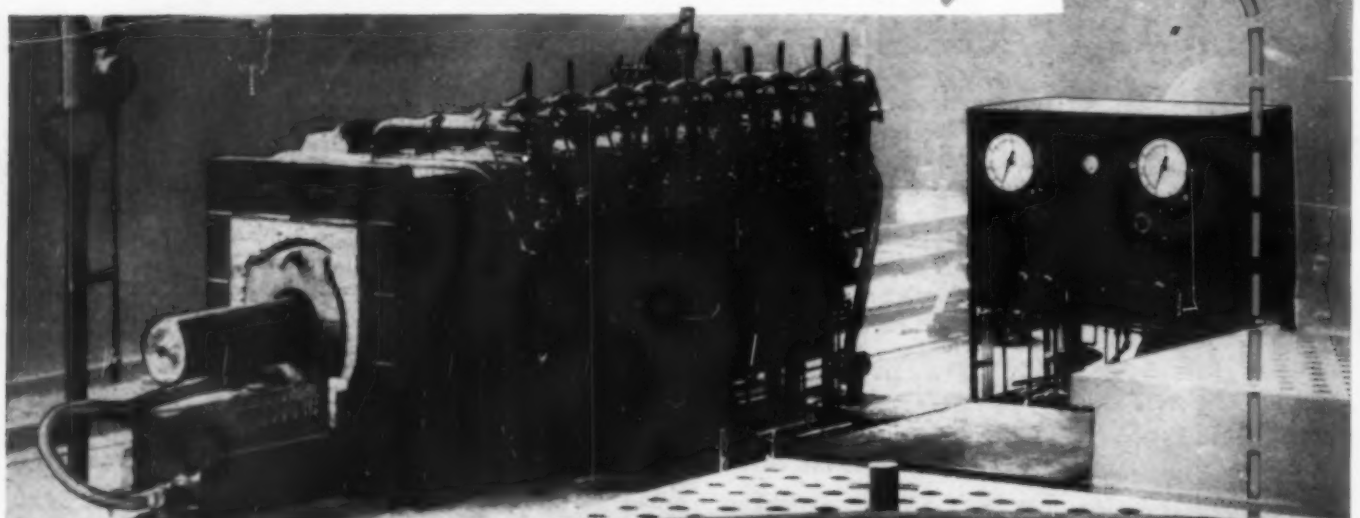

Heating Alloy Steel Piping Preparatory to Bending

Many of the alloys developed for high-pressure, high-temperature services and for corrosion-resistant applications are susceptible to loss of their valuable properties within certain temperature ranges as a result of excessive changes in metallurgical structure, surface oxidation, heat shock and cracking.

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101. Blow-Off Valves. Everlasting Valve Co., Jersey City, N. J.—4-page Bulletin describes the various blowoff valves available for boiler service. Sizes and dimensions of standard units are included.

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103. Sugar Equipment. Link-Belt Co., Chicago, Ill.—88-page Book No. 2240 gives information on such sugar processing equipment as screens, strainers, conveyors, etc.

103. Bowl Mills. Combustion Engineering Co., Chicago, Ill.—16-page catalog No. 62 outlines operating features of bowl mills for direct-firing rotary kilns.

104. Heat Exchangers. Schutte & Koerting Co., Philadelphia, Pa.—12-page bulletin 12H, presents design data and equipment sizes for this company's standard size heat exchangers and vapor condensers.

105. Stainless Valves. Cooper Alloy Foundry Co., Hillside, N. J.—80-page catalog No. 51 gives comprehensive information on stainless valves, fittings and accessories. Dimensions, weights and prices are included.

106. Pneumatic Conveyors. Allen-Sherman-Hoff Co., Philadelphia, Pa.—16-page catalog No. 448 illustrates types of pneumatic conveying systems produced by this company.

107. Alkane Sulfonic Acid. Standard Oil Co. (Ind.), Chicago, Ill.—22-page Technical Bulletin No. 11 gives detailed information on the alkane sulfonic acid produced by this company. Properties, applications, and materials of construction are included.

108. Scales. Yale & Towne Mfg. Co., Philadelphia, Pa.—68-page group of six bulletins presents specifications of the new line of dial scales recently introduced by this company.

109. Clarifiers. Harding Co., York, Pa.—12-page Bulletin No. 35-C describes clarifiers and other equipment produced by this company including digesters, filters, flocculating equipment and rotary driers.

110. Pressure Gages. Heise Bourdon Tube Co., Newtown, Conn.—15-page catalog describes the gages made by this company covering a pressure range from 0 to 10,000 psi. Methods of installation and prices are included.

111. Condensers. Elliott Co., Jeannette, Pa.—16-page Bulletin C-9 describes surface condensers from 500 to 15,000 sq.ft. in size. Data on auxiliary equipment is included.

112. Filters. Eimco Corp., Salt Lake City, Utah.—12-page Bulletin F-2012 illustrates types and sizes of this company's continuous vacuum filters.

113. Diamyl Phenol. Koppers Co., Pittsburgh, Pa.—24-page Bulletin C-8-110 details the physical and chemical properties of diamyl phenol. Typical reactions and uses, together with a bibliography, are included.

114. Perfume Chemicals. Givaudan-Delawanna, Inc., New York.—76-page Catalog No. 11, describes and lists the prices of the aromatic chemicals produced by this company.

115. Laboratory Apparatus. E. H. Sargent Co., Chicago, Ill.—32-page catalog illustrates this company's laboratory equipment. Prices are included.

116. Plastics. Bakelite Corp., New York, N. Y.—24-page booklet entitled "A Simplified Guide to Bakelite and Vinylite Plastics" describes uses for the various plastics put out by this company.

117. Tantalum Condensers. Fansteel Metallurgical Corp., North Chicago, Ill.—4-page Bulletin 3.503 describes corrosion resistant condensers produced from tantalum.

118. Permanent Magnets. Eriez Mfg. Co., Erie, Pa.—8-page Catalog No. 12 describes permanent magnet installations and equipment for removal of iron particles from materials in process.

119. Electric Motors. Allis-Chalmers, Milwaukee, Wis.—12-page bulletin is entitled "Handy Guide for Quick Selection

(Continued on page 328)

These are good for items in this issue only and must be returned by December 31, 1948.

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In addition to savings, the locomotive has furnished these other benefits. In and around the plant the absence of sparks has reduced the danger of setting paper and pulp wood on fire. There's no longer any need to take time for watering. No watchman is required to maintain a head of steam.

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ANNUAL INVESTMENT RETURN—32%!

HIGH AVAILABILITY

These diesel-electric locomotives are available for work 90 to 95 per cent of the time. This means you can have 8000 hours' operation out of an 8760-hour year.

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Chemical Crystal-Gazers!!!

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What can I do with this extremely reactive maleic acid derivative?

What new fields of chemical investigation are opened by this compound—an ester as well as an unsaturated solution, undergoing reactions typical of both chemical groupings?

Can you use this material in the manufacture of:

PLASTICIZERS? PHARMACEUTICALS? RUBBER CHEMICALS? RESINS? SURFACE ACTIVE AGENTS?... Here is a stimulating challenge for every alert practitioner of the chemical arts!

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ester as Diethyl Maleate

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Boiling Range at 40 mm of Mercury:
Not less than 90% distilling in a three degree range including 129°C

Melting Point: - 10° to - 12°C

Acidity as Maleic Acid: 0.015%
by weight maximum

Water: 0.5% by weight maximum

Color: Water-white

CSC

For additional data and sample quantities, write or phone

Commercial Solvents Corporation

17 East 42nd Street
New York 17, N. Y.

NEW PRODUCTS AND MATERIALS

Joseph A. O'Connor, ASSISTANT EDITOR

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FOR MORE INFORMATION
See Reader Service
Coupon on pages 157-158

51. Plastic Pipe

LIGHT-WEIGHT plastic pipe that will withstand working pressures up to 650 psi. at temperatures up to 100 deg. F., has been developed to replace harder-to-get metal pipe. This Extrulite Pipe will safely handle a variety of fluids, including water, natural or manufactured gas, organic solvents and alkalis. It makes up with standard dies, tees, elbows and joints. Three and one-half feet of 1-in. pipe weighs only 1 lb. Light weight and easy threading make this pipe ideal for quick permanent or temporary piping arrangements. It is now available in standard heavy-wall pipe sizes from $\frac{1}{4}$ in. I.D. to 3 in. I.D. from Extruders, Inc., of Culver City, Calif., the manufacturers.

52. Ultra-Fine Alumina Powders

TWO HIGH-PURITY alumina powders characterized by ultra-fine, uniform particle size, exceptional hardness and large surface area, are now offered in commercial quantities by the Linde Air Products Co., a unit of Union Carbide & Carbon Corp. Both of these Linde powders have a high degree of purity (99.9+ percent Al_2O_3), are unaffected by acids and by 30 percent NaOH at 80 deg. C. Type A-5175, alpha aluminum oxide, has a hexagonal crystal structure and a hardness of 9 on Moh's scale. Particle size is approximately 0.3 micron and the apparent density 4 g. per cc. The second powder of this class is Type B-5125, gamma aluminum oxide, having a cubic crystalline form and a hardness of 8 on Moh's scale. Particle size is less than 0.1 micron, and apparent density 3.6 g. per cc.

These fine powders have already been successful as ultra-fine abrasives in metallographic polishing. In view of their over-all physical and chemical properties, they show promise in optical and gem polishing, metal finishing, as ingredients in the manufacture of phosphors, and as catalyst carriers in chemical processes.

53. Dicapryl Sebacate

OUTSTANDING plasticizer for vinyls is dicapryl sebacate, just introduced to industry by the Hardesty Chemical Co., Inc., after extensive testing.

Dicapryl sebacate is one of the lowest-cost plasticizers in the top-quality bracket. It imparts flexibility, which is maintained down to extremely low temperatures (even at −75 deg. F. it does not crack), a quality reflected in its good handling properties over normal temperature variations. Vinyl film plasticized with dicapryl sebacate resists volatility loss. As little as 1 percent loss in 24 hr. at 250 deg. F. in a moving air current has been reported. The plasticizer has good resistance to water, light and aging. Its high purity and constancy of color permit the widest range of use of pigments and color combinations.

Dicapryl sebacate is best described as a high-boiling ester having a molecular weight of 426, an NPA color of 0.5, a boiling point of 231.5-239 deg. C. at 4 mm., a specific gravity of 0.9136 and a Saybolt viscosity of 73.8 sec. at 100 deg. F.

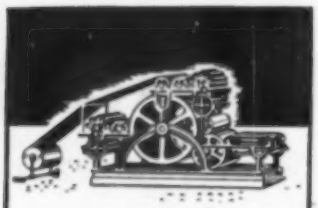
The new plasticizer for vinyls is now available in commercial quantities. Samples can be secured from the Hardesty Chemical Co. in New York.

54. High-Temperature Thermoplastic

LIMITED quantities of Kel-F, an unusually stable, high-temperature thermoplastic, are now being produced commercially by M. W. Kellogg Co., of Jersey City, N. J. The new plastic is a polymer of trifluorochloroethylene. It is colorless and transparent, but it can be blended with solid fillers and coloring agents. Outstanding characteristics of Kel-F are its high impact strength at low temperatures and its resistance to thermal shock.

Kel-F exhibits the high-stability properties of the fluorocarbons combined with an unusual "balance" of commercially useful physical properties. For example, although extremely resistant to chemical action, it is easily worked in conventional equipment; although it is strong and hard, it is not brittle; although it can be used at relatively high temperatures, its performance is very satisfactory at extremely low temperatures. It can be heat-treated in a manner similar to the tempering of metals to impart desirable permanent characteristics at the temperature of use.

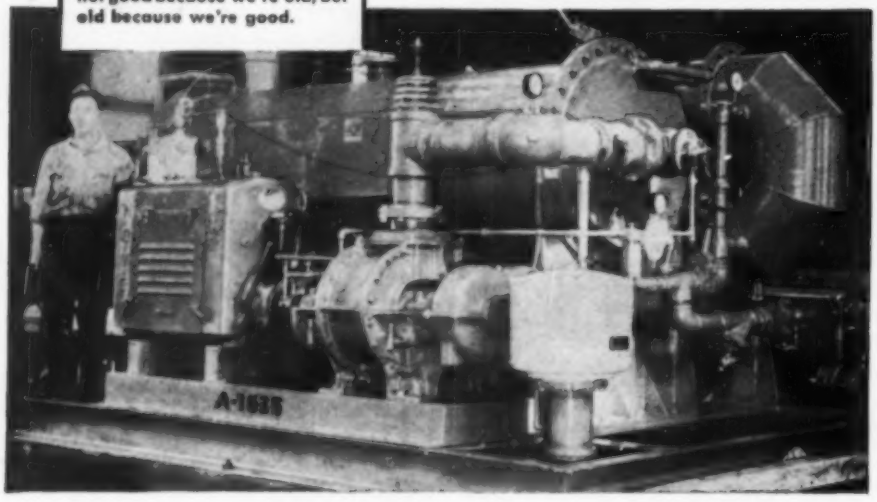
Here are the properties of Kel-F: specific gravity, 2.1; tensile strength at

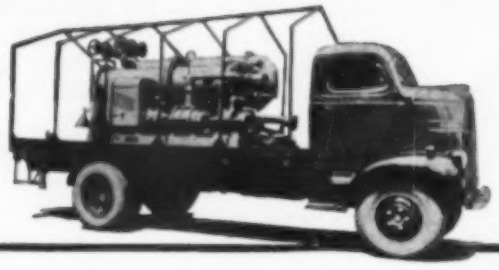


In 1865, William Bullock built the first press which printed from a continuous paper web or roll. Eleven years earlier, the first Roots Blower was built. We're not good because we're old, but old because we're good.

SMOTHER EXPLOSION HAZARDS

with R-C Inert Gas Generators





(Above) R-C Inert Gas Generator in oil refinery. Oil-fired, engine-driven. Capacity 45,000 CFH.

(Left) Portable unit, on truck, for fast service by public utility. Capacity 15,000 CFH.

Wherever inflammable gases or liquids are processed, handled or stored, there exists danger of fire or explosion. Such hazards are minimized in many plants with R-C Inert Gas Generators, which produce cheaply a mixture of nitrogen and carbon dioxide, in either stationary or portable units, with oil or gas for fuel.

R-C Inert Gas Generators have these outstanding advantages:

- Larger capacity in terms of weight and cost
- Low operating and maintenance cost
- Quick adjustments for complete combustion
- No adjustments, for same fuel, needed after shut-down
- Operation not affected by variations in back pressure
- Extremely quiet operation

Many years of satisfactory performance have proved the desirable qualities of R-C Inert Gas Generators. They are available in capacities from 1,000 CFH, up. For explosion or fire protection, or for inert gas production for processing operations, you'll obtain complete dependability from R-C equipment. For details, send for Bulletin 100-B14.

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87 deg. F., 9,400 psi.; elongation at break at 86 deg. F., 127 percent; coefficient of linear expansion (−320 deg. F. to 167 deg. F.), 3.5×10^{-6}; specific resistance, 5×10^{17} ohms; dielectric strength, short time, 2,500 volts per mil; dielectric constant at 60 to 10^6 cycles, 2.3 to 2.7; water absorption, 0.00 percent; outdoor weathering, no detectible change.

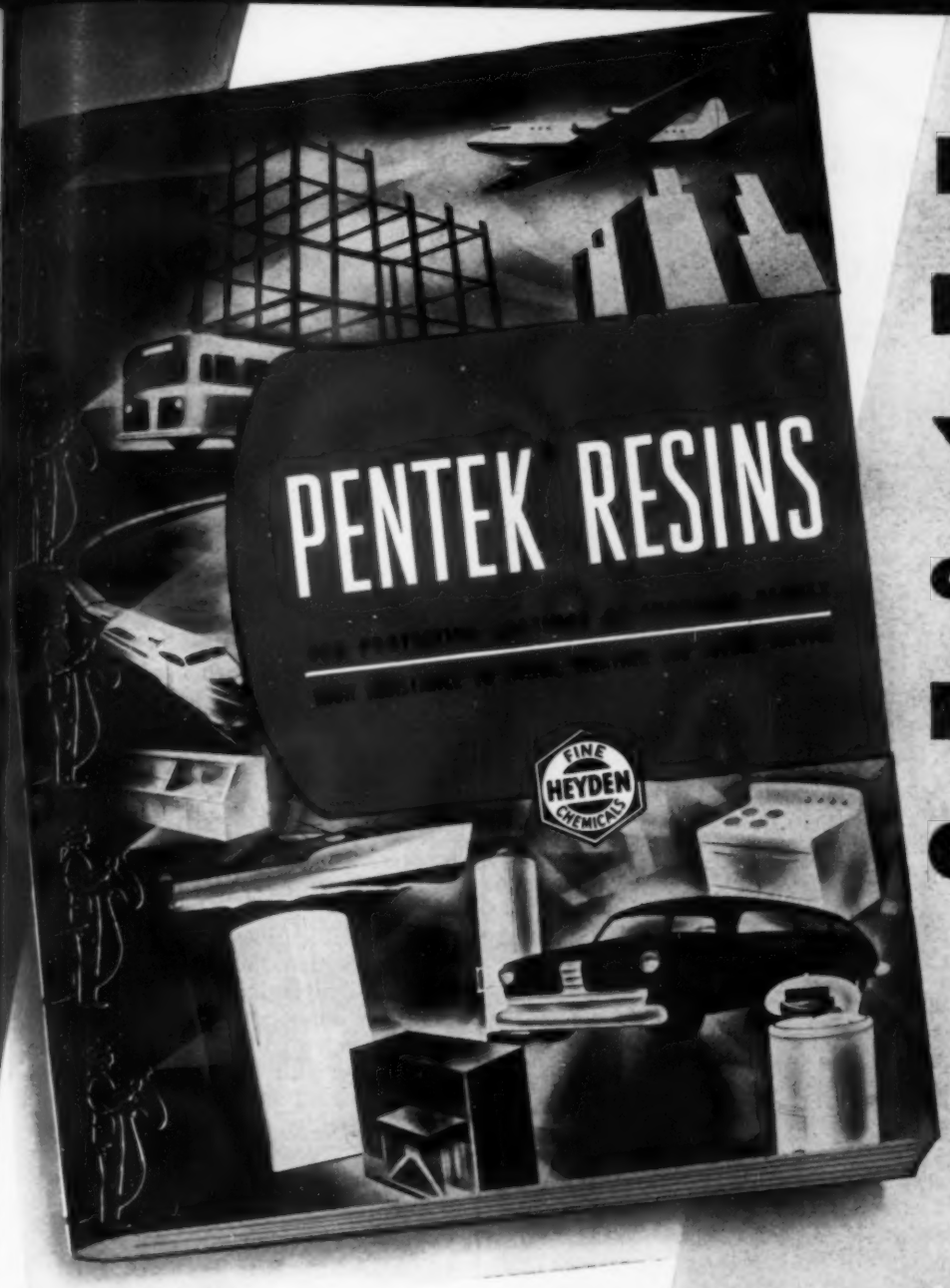
Kel-F is highly stable, resisting concentrated sulphuric, hydrofluoric and hydrochloric acids, strong caustic, fuming nitric acid, aqua regia and other strong oxidizing agents. Kel-F has low cold flow; while it deforms slightly under pressure, it returns to its original shape when the pressure is released. Extensive observation of the new plastic shows it to have satisfactory properties over a temperature range of 700 deg. F., from a low of −320 deg. F. (liquid nitrogen) to a high of 390 deg. F. The thermoplastic is also a good electrical and heat insulator. Another property of Kel-F is that it is not wetted by water, being unaffected by high humidity or tropical exposure.

With good fabricating characteristics, Kel-F can be fabricated in conventional machines designed to operate between 550 and 600 deg. F. It can be compression-, transfer- or injection-molded, or extruded. It has been fabricated in sheets, films, tubing, rods, shaped pieces and insulation on wire. It can be readily punched and drilled or machined to close tolerances.

For a plastic, Kel-F takes heat treatment remarkably well. The properties of the new plastic can thus be varied over a considerable range. Stable properties at use temperatures are obtained by heat treatment at considerably higher temperatures. In this way the plastic can be made relatively soft and resilient, resembling a plasticized material, or harder and less yielding. Stability of the plastic is not sacrificed. And no plasticizing agent is required.

Practical Applications

Pump packings, valve seats and valve packings, wherever corrosive gases and liquids are handled, are excellent applications of Kel-F. Transparent, it can be used instead of glass in gages and flowmeters. It is useful in laboratory and instrument tubing. It can be laminated with wire cloth or glass cloth, where added mechanical strength is needed in addition to chemical inertness. Since it withstands weathering, Kel-F can be used in signal devices for railroads, in airplane and ship parts, instruments, outdoor seals and electrical insulation. Its low cold flow makes Kel-F a good medium for gaskets, pump diaphragms and valve seats (particularly for air or gas



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New **TOLHURST variable speed centrifugal with hydraulic drive**

IDEAL FOR LABORATORIES AND PILOT PLANTS

Meet the new Tolhurst Variable Speed Centrifugal, the only machine of its type with variable speed hydraulic drive and hydraulic braking. Smooth, stepless speed variation ranges from 0 to 2150 RPM, with centrifugal force range up to 1700 times gravity. Overload protection is inherent in the drive; machine can be stalled indefinitely under load without damage.

This new centrifugal is available with baskets — perforate or imperforate — 20" and 26" in diameter. Drop-bottom case provides easy interchangeability of baskets. Additional features include counterbalanced unloader and tachometer to indicate basket speed. Standard single speed squirrel cage motor can be open, totally enclosed fan cooled or explosion-proof, as specified. When required, this machine can be made completely fume-tight (as shown in illustration).

SPECIFY TOLHURST CENTRIFUGALS FOR SPEED AND CONVENIENCE IN

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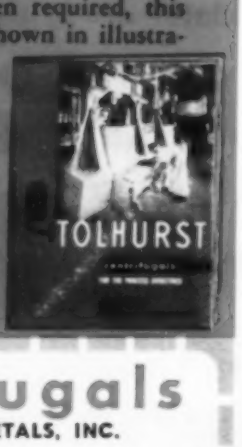

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pressure release valves). It is also a desirable wire-coating material where pressure due to several layers of wire might cause enough cold flow to short-circuit electrical equipment. Its usefulness over a wide temperature range suggests applications for Kel-F in liquid air and oxygen plants, in refrigerating systems and in low-temperature chemical reactions. A good electrical and heat insulator, it can be used in motors, process control instruments and radio for operation at high temperatures and under corrosive conditions. Kel-F would be particularly useful where a long-lived wire insulation requiring a minimum of maintenance is called for.

55. Enzymes

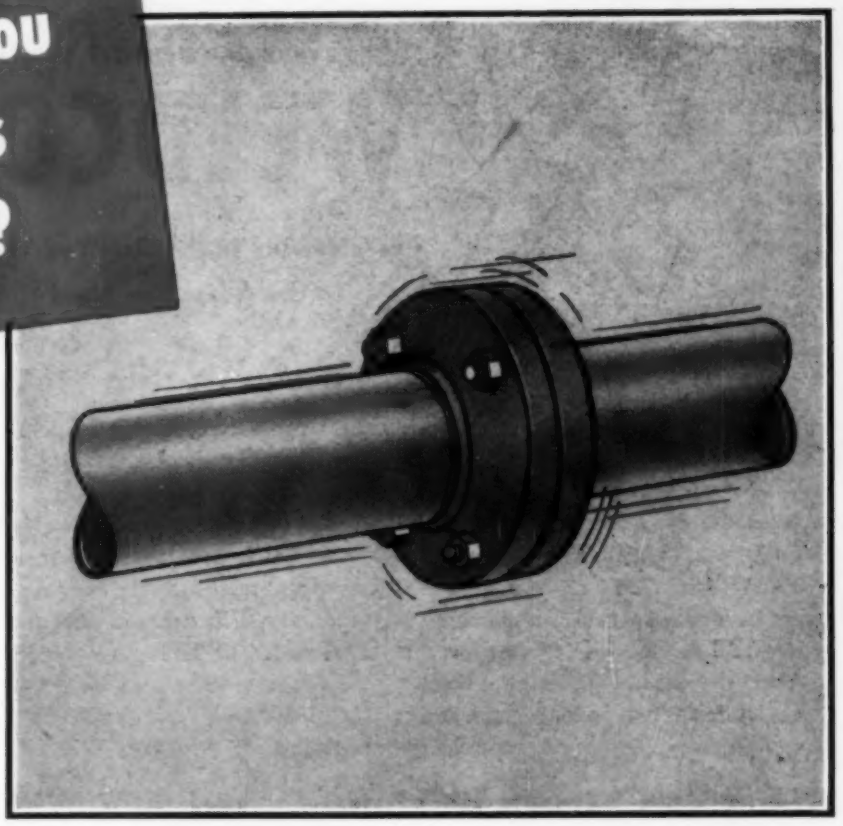
LATEST addition to the series of textile desizing agents, manufactured by Rohm & Haas Co., West Washington Square, Philadelphia, Pa., is a new liquid diastatic enzyme concentrate. This new product, under the trade name Rhozyme LA, is claimed to combine the recognized economy of a liquid enzyme with good stability at high temperatures making possible thorough and uniform desizing in the fastest possible time. The manufacturer states that the introduction of this new desizing agent offers textile processors the opportunity of utilizing the efficiency of high-speed, continuous desizing with maximum economy. Other desizing agents made by this company are dry, stable powders. One of these is a concentrated diastatic enzyme powder and the other a concentrated protolytic enzyme powder.

56. Molding Powder

A NEW Hycar-phenolic molding powder which will provide high shock-resistance characteristics to instrument cases, knife handles, power-tool handles and which is also useful for a variety of other applications where there is rough treatment, has been developed by the Compound Division of the General Electric Co.'s Chemical Department. The new compound possesses the good moldability and heat resistance of wood-flour-filled phenolics and is strengthened by the toughness and resiliency of Hycar-American rubber, a product of the B. F. Goodrich Chemical Co., to the point where it can replace cotton-flock and rag-filled compounds for many applications.

Tests indicate that the new compound, known as GE 12446, has a much higher impact resistance than standard wood-flour-filled phenolic materials. It possesses low bulk factor,

How would you insulate this steam line?



A newly installed line carrying steam at 650° F. is subject to severe vibration from near-by traffic. Because of the high temperatures in the line, it should be insulated as soon as possible. On flanges the insulation must be removable. Which of these materials would you select?

- ☐ 1¼" high temperature and 1½" 85% Magnesia pipe covering
- ☐ 2" Bestfelt pipe covering

Here's what the Armstrong Engineer recommended:

On this particular job, either of the two specifications is adequate for the 650° F. temperature involved. However, there were other factors that led the Armstrong engineer to recommend Bestfelt on the line and flanges.

Not only is 2" of Bestfelt less expensive than the combination covering but, under severe vibration conditions, Bestfelt will not crumble or crack. Because of its toughness and flexibility, Bestfelt can be used for removable flange covers without a framework of hardware cloth. And today, it can be delivered more promptly than combination covering.

Bestfelt is made of layers of finely crimped asbestos paper—about 33 laminations per inch of thickness. Its efficiency is somewhat better than combination covering, making a 2" thickness of Bestfelt practically as effective as almost 3" of combination covering.

★ ★ ★

In designing a piping layout, the architectural engineer has plenty of problems without concerning himself with the fine details of insulation specifications. There's one man whose job calls for making these fine distinctions. He's the Armstrong engineer. His long experience helps him foresee the conditions under which insulation must operate. His suggestions at the planning stage can save you time, trouble, and dollars.

This engineering "know-how" is just one of the advantages of Armstrong's nation-wide contract service. The complete service includes proper insulation materials and also the expert workmen to install them. Next time you have a heat insulation job coming up, call Armstrong's nearest district office for an estimate.

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This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Co., Industrial Insulation Department, 3310 Maple Ave., Lancaster, Penna.

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Today, Tomorrow —Always

THE fundamental policy of our Company, a heritage we value, is to make our products and our organization of such unfailing service that neither time nor circumstances shall interfere. Our long experience in manufacturing specific chemicals enables us to keep our unwritten pledge to all we serve.

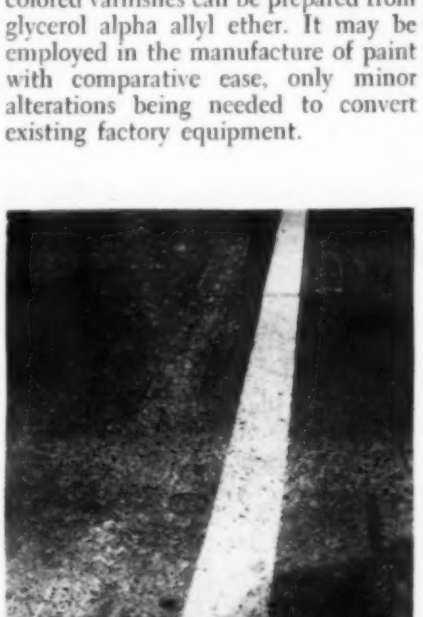
OLDBURY
ELECTRO-CHEMICAL COMPANY
Plant and Main Office:
NIAGARA FALLS, NEW YORK
New York Office:
19 RECTOR STREET, NEW YORK 6, N. Y.

pours easily in powder form and provides good finish. It can be rapidly preformed in automatic equipment.

The compound can be molded into complex parts by either compression or transfer methods in molds designed for ordinary wood-flour-filled phenolics. Its inherent resiliency permits the new material to be molded around large complex inserts without cracking and around inserts subjected to flexing and vibration. Another feature of GE 12446 is its good thermal-shock resistance. This permits molded parts to be subjected to an instantaneous drop over a wide temperature range without cracking.

57. Varnish Materials

A SYNTHETIC chemical made from petroleum, glycerol alpha allyl ether, has been developed by the Shell Development Co., 50 West 50th St., New York, N. Y. This new petroleum chemical is made from propylene, a petroleum gas. Tests show that varnishes made from this material give a surface of unusual hardness, good flexibility, and good toughness. They can be used on glass, wood, steel, tin, aluminum or copper. Either clear or colored varnishes can be prepared from glycerol alpha allyl ether. It may be employed in the manufacture of paint with comparative ease, only minor alterations being needed to convert existing factory equipment.



Cross line B is paint based on Pentalyn 802A and Parlon. Lines A and C are paint meeting state specifications. All lines have been down two months.

58. New Traffic Paint

A NEW traffic paint based on two Hercules Powder Co. chemicals, Pentalyn 802A, a synthetic resin, and Parlon, a chlorinated rubber, has proved to possess outstanding durability and

CENTRIFUGAL PUMPS FOR EVERY SERVICE

Cut down on the "HIDDEN" Pumping Costs!

PUMPS by "Buffalo"

YOUR "BUFFALO" REPRESENTATIVE

knows pumps "inside and out"—get his recommendations on the pump your operation needs! Representatives in principal cities

"BUFFALO" TYPE "DS" PUMPS CUT THE BIG COSTS—SHUTDOWN TIME COSTS

LOSS of process or production time may not show up in the pump repair bill—but it's the major cost when a pump breaks down!

With "Buffalo" Pumps on the job, you can just about write off time loss on that account. For instance, the "Buffalo" Diagonally Split-Shell Pump above is RUGGED from its rigid stand to its oversize shaft and bearings. Impellers are heavy-duty, efficient enclosed design. Stuffing boxes are extra deep. And the split-shell design allows quick, easy inspection of all inside parts.

If you're looking for a pump you can "put in and forget", write us for the facts on "Buffalo" Type "DS" Pumps.

For

- WATER ANY TEMPERATURE
- PAPER STOCKS (NON-CLOGGING)
- GENERAL SERVICE
- ACIDS
- ALKALIS
- SLURRY
- CONDENSATE RETURN
- SUMP CLEARANCE
- FIRE SERVICE
- SEWAGE
- SELF-PRIMING SERVICE

BUFFALO PUMPS, INC.

501 BROADWAY BUFFALO, NEW YORK

CANADA PUMPS LTD., KITCHENER, ONT.

RUGGED, PRECISION CONSTRUCTION—FOR LONG LIFE

THIS KIND OF *Chemical Process Equipment* DEFIES CORROSION ATTACKS!

Acid-proof stack lined with brick, joined with Atlas VITREX — impervious to temperatures to 1600° F. and to acids of any concentration. VITREX is used in acid towers, fume ducts, stacks, acid evaporators and tanks.

Battery of 87 concrete tanks, each 7' x 4' x 9', lined with Atlas Atlastiseal and brick joined with KOREZ. These electrolytic tanks handle 20% H_2SO_4 and 20% $CuSO_4$ at 180° F.

Floor of Atlas acid-proof brick in dye and pigment plant. Floors joined with Atlas ALKOR (the original acid- and alkali-proof cement) take temperatures as high as 360° F.

You can now have tanks, floors, towers, stacks, drains, pits — and other processing equipment completely immune — not merely *"resistant"* to the attack of acids, alkalis, corrosive salts and solvents — also to high temperatures, including steam and hot water • These units will be planned to meet your special and individual requirements • Atlas patented DUAL CONSTRUCTION, applicable to certain units, reduces labor costs, gets unit into active service in much shorter time — and permits the handling of corrosives at up to their boiling points • *Atlas Materials* include cements, brick, plastic linings, joining materials and protective coatings, which immunize structural members of concrete, steel and wood against corrosion attack • *Atlas Service* is complete and nation-wide • Our representatives are competent to advise you and our engineers will gladly make a study of your acid-proofing problem and submit plans and estimates — without obligation • Contact our nearest branch. Write us at Mertztown for Technical Bulletin T10-B.

THE *Atlas Mineral*

PRODUCTS COMPANY OF PENNA.

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*ATLANTA 3, Ga., 452 Spring St., N. W.	PITTSBURGH 27, Pa., 4921 Plymouth Rd.
*CHICAGO 1, Ill., 333 No. Michigan Ave.	PHILADELPHIA, Pa., 355 Fairview Rd.
*DETROIT 2, Mich., 2970 W. Grand Blvd.	Springfield, Pa.
NEW YORK 16, N. Y., 280 Madison Ave.	ST. LOUIS 8, Mo., 4485 Olive St.

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS, INC. Box 252, Houston 1, Texas

*BERKELEY 2, Calif., 605 Addison St.	OMAHA, Neb., 423 South 38th Ave.
DALLAS 5, Tex., 3921 Purdue St.	*LOS ANGELES 12, Cal., 172 S. Central Ave.
*DENVER 2, Colo., 1921 Blake St.	NEW ORLEANS 12, La., 208 Vincent Bldg.
*HONOLULU 2, Hawaii, U.S.A.	*SEATTLE 4, Wash., 1252 First Avenue, S.

*Stock carried at these points

IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal 3, P. Q., 86 Bloor St. W., Toronto, Ont.

rapid dry. Pentalyn 802A is a phenolic-modified pentaerythritol ester of rosin.

Test cross lines laid down on a highway intersection in South Camden, N. J., considered to be the second busiest highway intersection in the state, show little signs of wear after more than two months of service. Cross lines of a specified formulation in current use by the state were laid down at the same time alongside the Pentalyn 802A-Parlon paint, and were almost worn away at the end of the two months. The test lines were applied to both concrete and asphalt surfaces.

Traffic paints based on Parlon and Pentalyn 802A are outstanding from the standpoint of durability and speed of drying. Drying speeds of these paints vary from 11 min. to 20 min., depending on such factors as thickness of film and type of solvent. The fast drying time reduces the amount of time traffic has to be rerouted. The outstanding durability means fewer applications per year, with consequent savings in man-hours and paint gallonage. When applied with conventional traffic-marking equipment on asphalt surfaces, these paints do not cause bleeding.

59. Synthetic Enamel Finish

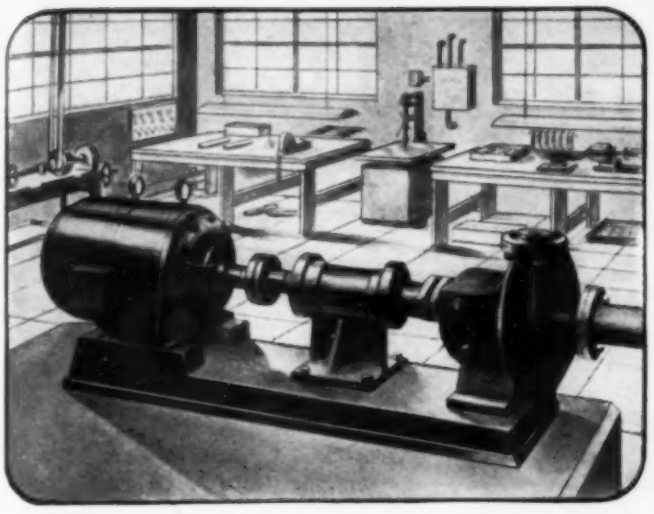
DESIGNED to give porcelain "a run for its money," a new synthetic enamel finish has been developed by paint engineers of the Sherwin-Williams Co. Already, it has found many uses in fields previously dominated by porcelain.

Stimulus for bringing out the new finish, called Superclad, is the shortage of enameling steel. One large manufacturer is reported using the coating for finishing aluminum washing machine tubs as a replacement for standard porcelain tubs. Other uses are seen in coatings for such appliances as mixers and refrigerators.

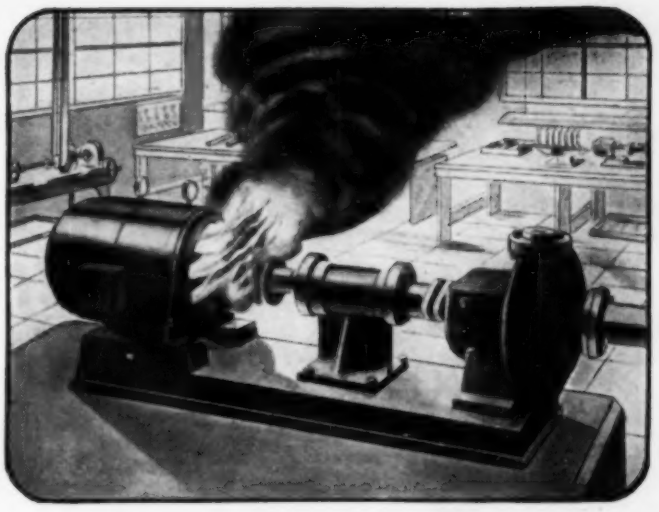
High resistance to alkalis and acids is indicated. Laboratory tests using a 10 percent alkali solution, or a 10 percent solution of sulphuric acid, showed that the new finish was in good condition even after 18 months' exposure, while ordinary top-quality enamels in the same tests failed in 24 to 48 hr.

60. Phenosulfazole

SUCCESSFUL against a polio virus in mice, American Cyanamid Co.'s new sulfa drug phenosulfazole (trade name, Darvisul) may someday be used to treat human victims of poliomyelitis. As yet, however, it is not known what the drug's effect on man would be;



Before a small motor—



can touch off a major fire—

CATCH THE FLAMES IN TIME

THE *Kidde* WAY!

Overworked or overloaded motors in your plant—even the smallest—can be a potential fire hazard. Play safe—keep *Kidde** Portable Extinguishers close at hand!

A *Kidde* Portable discharges dry, clean carbon dioxide (CO_2) that can quickly put out electrical fires—without damaging the insulation or corroding metal parts. Since CO_2 is non-conducting, a *Kidde* Portable is safe to use even if circuits are live.

Sizes range from 2½ to 25 pounds CO_2 capacity—a size for every need in portables. All *Kidde* Portables have fast-acting, easy-to-use TRIGGER-FINGER CONTROL. Ask a Kidde representative for full details.

*Also sold under the name "LUX."

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

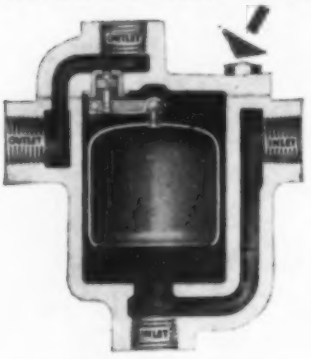
Walter Kidde & Company, Inc. • 1028 Main St., Belleville 9, N. J.

CHOOSE CLARK
All down the line

A NEW TRAP
JOINS A
FAMOUS LINE ---

Clark Traps

INTRODUCING THE NEW CLARK "60"



Series "80"
Inverted Bucket
Steam Trap

"CRV"
Pressure
Regulator

A small trap with big trap features. Positive seating with guided disc. Equipped with *two inlets* and *two outlets* for easy installation for horizontal, vertical or angle connections.

Let Clark's 40 years of experience be your guide in selecting the proper trap or valve for your drainage needs.

Series "70-T"
Inverted Bucket and
Blast Steam Trap

Write today for complete story on Clark Traps and Valves.

THE CLARK MANUFACTURING CO.
1833 EAST 38th STREET • CLEVELAND 14, OHIO

Series "70"
Inverted Bucket
Steam Trap

Clark

TRAPS — FLOAT, INVERTED BUCKET, OPEN BUCKET AND VACUUM • REDUCING VALVES • STRAINERS

nor will this be known until much more research is done.

A series of investigations have been conducted at the Lederle Laboratories Division of American Cyanamid and at Columbia University's College of Physicians and Surgeons. In the mice, three results have been observed: the drug cures mice in the early stages of the disease; the mice that survive are immune to reinfection; and when the drug is given in a single dose orally, it prevents infection. Thus for the first time a virus disease in mice has been successfully attacked by a man-made chemical. It was Cyanamid's Calco Division that synthesized phenosulfazole.

The drug Darvisul is a white powder which goes into solution only with difficulty. Since the powder is not sufficiently absorbed in the animal's body, a sodium salt of the drug is used. This salt is soluble, non-toxic and generally satisfactory as a material to be injected.

61. Woven Plastic Screening

LUMITE, a new woven plastic screening, is being made by the Lumite Division of the Chicopee Mfg. Corp. Lumite is produced from Dow's Saran, a vinylidene chloride product. The color pigment is blended directly into the basic plastic monofilaments. This guarantees that the screen cloth will not fade or streak. Easily kept clean by washing with a damp cloth and soapy water, Lumite window screening never needs painting. It also cuts maintenance and replacement costs as the screening can be left on the windows all year round, if necessary.

The new screening material is being used by Smith & Hill, Inc., builders of model modern homes. Utilized on the breezeways and the casement windows of the newly constructed homes, Lumite screening is used throughout the Oak Meadows and Park Ridge projects in one of Chicago's finest suburban areas.

An unusual feature of this new window and door screen material is that it will not rust or stain nor mar the sides of buildings, according to the makers. Besides being stainproof and rustproof, Lumite screening also withstands abuse due to its high tensile strength. Its flexible nature makes it easy to cut and to install.

62. Co-Plasticizer

IMMEDIATE availability of increased quantities of plasticizer HB-40 has been announced by Monsanto Chemical Co. The product is a partially hydrogenated mixture of isomeric terphenyls. Practically non-toxic, HB-40

VESSEL DIVISION

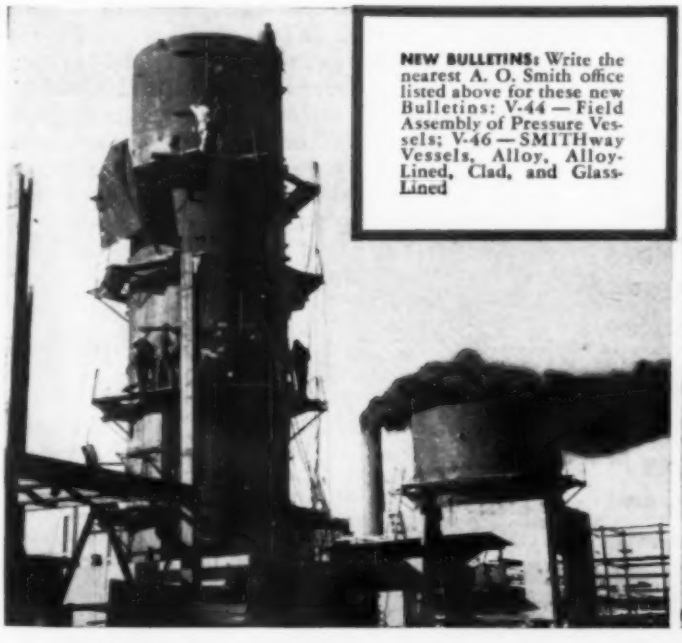
NEWS

A. O. SMITH Corporation

New York 17 • Philadelphia 5 • Pittsburgh 19 • Atlanta 3 • Chicago 4
Tulsa 3 • Houston 2 • Seattle 1 • Los Angeles 14
International Division: Milwaukee 1

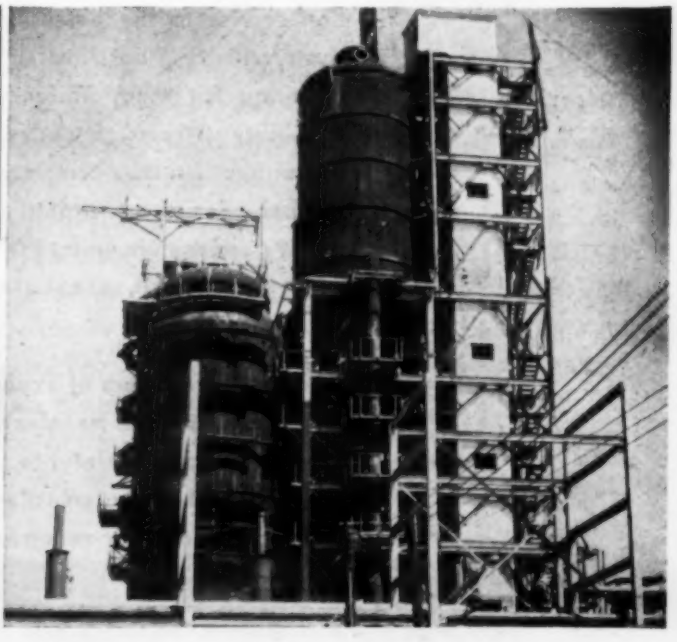
TEAMWORK GETS RESULTS. This is the team that field-erected the SMITHway Vessels for the refinery shown below.

Harold Pollei (right), supervisor of A. O. Smith Field Service, is backed up by the vast metallurgical, welding, spectographic, and electrical laboratory facilities of A. O. Smith in solving the daily technical problems with Harry Drummond (left), job superintendent on the field work, and two of his foremen.



NEW BULLETINS: Write the nearest A. O. Smith office listed above for these new Bulletins: V-44 — Field Assembly of Pressure Vessels; V-46 — SMITHway Vessels, Alloy, Alloy-Lined, Clad, and Glass-Lined

CRUDE OIL UNIT. Left, fractionating column, 14 ft. dia. x 89 ft. 8 in. high, weight 165,000 lb., SMITHlined with monel and type 405 stainless steel. Right, vacuum column, 22 ft. dia. x 51 ft. high, weighing 183,000 lb., SMITHlined with type 405 stainless steel.

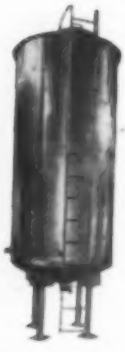


FLUID CATALYTIC CRACKING UNIT NEARING COMPLETION. At left is the regenerator, 20 ft. dia. x 79 ft. 8 in. high, weighing 334,000 lb. Right, the reactor, 22 ft. 6 in. dia. x 62 ft. high, weight 266,000 lb., is carbon moly SMITHlined with type 405 stainless steel.

OUR HEAT TRANSFER SPECIALTIES

YOUR HEAT TRANSFER REQUIREMENTS

KETTLES—Plain, Jacketed, Mixing
AUTOCLAVES—For General Use
HEAT EXCHANGERS—Straight and U-Tube
COOLERS—For All Liquids and Gases
STORAGE HEATERS—For All Liquids
HEATERS—For all Liquids and Gases
BOILERS & REBOILERS—Heated by Steam, Electrically, or Any Preheated Transfer Medium
STILLS—Vacuum or Pressure



The list, which is only partial, is typical of our design and construction service to the processing industry. All are "heat transfer" units, requiring for their efficiency and durability a thorough understanding of heat transfer principles and the behavior of the various industrially used metals under the stress of temperature, pressure and corrosion.

Our sixty-nine years of experience in the field of "heat transfer equipment" should be helpful to you in connection with the selection and construction of your requirements.

EST 1880 THE PATTERSON-KELLEY Company Inc.
109 WARREN STREET, EAST STROUDSBURG, PA.

New York Office: 101 PARK AVENUE, Zone 17
Offices or Representatives in Principal Cities

is a relatively non-migrating plasticizer with average low-temperature and volatility characteristics. Its relatively low cost makes it an economical and effective extender for primary plasticizers selected to give outstanding low-temperature and volatility performance. According to Monsanto, HB-40 is of special interest as a co-plasticizer for polystyrene, vinyl resins, ethyl cellulose and asphaltic materials. Suggested uses for HB-40 are in polystyrene casting resins, plastic emulsions including adhesives, plastic paints, coatings and extrusions. The new plasticizer imparts good tensile strength, elongation, and moisture resistance to plastics. Because of its effective electrical properties, it may be used with plastics in the manufacture of insulation and plastic parts for electrical equipment. It may also be used as a diffusion-pump oil, high-temperature lubricant and heat-transfer medium.

63. Phenol Alkyd Resin

LATEST addition to the line of phenol modified alkyd manufactured by the Reichhold Chemicals Inc., Detroit, Mich., is No. 1341 Beckosol. Originally developed as a vehicle for high grade drum paints requiring a fast-drying cycle and good durability, this material was used successfully to withstand unfavorable weather conditions. This material is a stable resin with good pigment compatibility, high viscosity at low solids and good water and salt spray resistance. It has been utilized in the formulation of toy enamels, machinery enamels, chassis enamels, and low-cost automotive refinishing enamels. Beckosol 1341 can be blended with 25 percent chlorinated rubber to produce films that are tack-free in 7 to 8 min. and print free in 25 to 30 min. The resin is suggested as a replacement for ordinary nitrocellulose lacquers or varnishes in many air-dry and low-bake furniture finishing operations.

64. Treated Wooden Pipe

TO PROTECT its products from decay and insect attack, the Michigan Pipe Co., of Bay City, Mich., is now offering for the first time wooden and wood-lined pipe treated with pentachlorophenol. This compound is found to be highly toxic to all decay-producing fungi, as well as termites and other wood-destroying insects. Since the preservative is non-volatile and insoluble in water, it assures protection in the treated lumber for a long period. It is clean and free from objectionable odors, which makes it easy to handle.

TUBING VALUE

FOR INSTRUMENT LINES

Today's best buy for pneumatic and hydraulic instrument lines is Alcoa Aluminum Tubing. It costs less per foot than any other easy-to-form, small-diameter tubing.

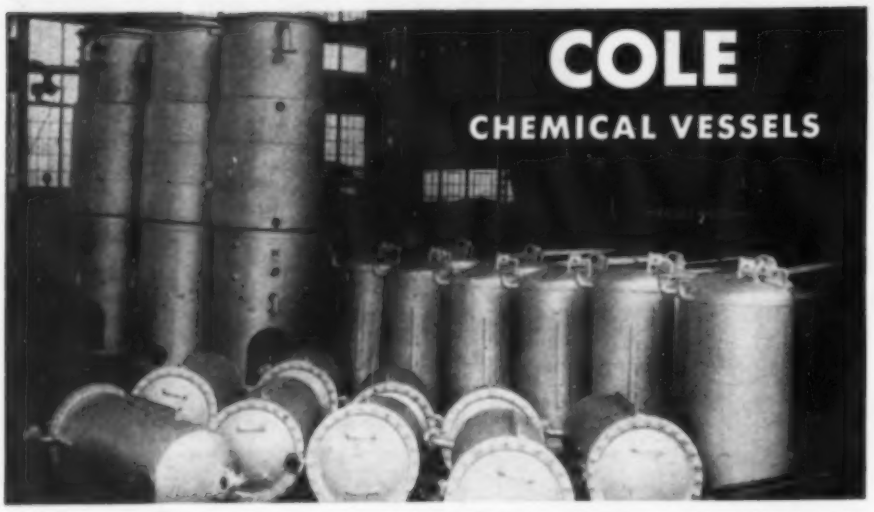
You'll like the ease of bending and flaring Alcoa Aluminum Tubing. It's light, but strong and pressure-tight. It has high resistance to corrosion by moisture, H_2S, ammonia fumes, and refinery atmospheres.

Take advantage of the characteristics of aluminum in your operations by using it wherever possible. You will find that the use of aluminum fittings will contribute greatly toward the over-all performance of your tubing systems.

Ask your nearby Alcoa Distributor about the availability of Alcoa Aluminum Tubing. Or call your local Alcoa Sales Office. ALUMINUM COMPANY OF AMERICA, 2151 Gulf Building, Pittsburgh 19, Pa.

ALCOA

ALCOA *Aluminum* TUBING

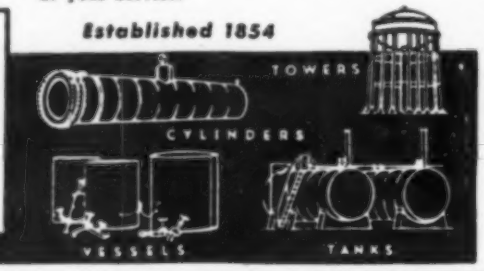


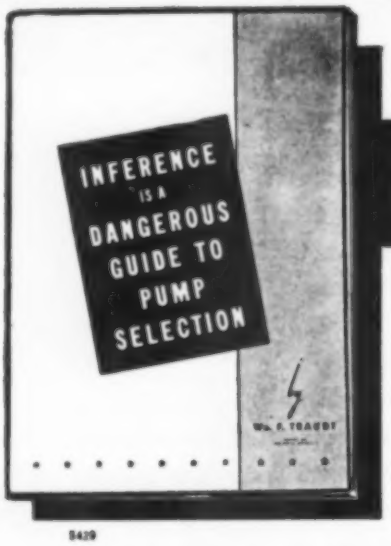
For HIGH Quality—
LOW Maintenance

For superior performance and minimum maintenance, Cole products lead the field. Starch kettles, vats, kiers, pressure vessels — our facilities and experience enable us to give you the best in all types of processing equipment, whether stainless clad steel Monel, special alloys, or kindred materials. Our engineers are at your service.

R. D. COLE
MANUFACTURING CO.
NEWNAN, GA.

Established 1854





S429

LEARN THE
BASIC FACTS
BEFORE DECIDING
UPON TYPE OF PUMP

Fault-filled enthusiasms for certain types of pumps now running rampant in industry, are dangerous. Because a *type* of pump performs sensationally on somebody else's job, it isn't necessarily certified to your use.

The unbiased, basic facts concerning types of pumps are contained in our special bulletin S-416. Big illustrations and briefed descriptions deal with the capacities and adaptability of such types as piston, plunger, rotary and centrifugal pumps. We'll gladly send a copy free, if you will request it on your company letterhead.

TABER PUMP CO. • *Est. 1859* • 294 ELM ST., Buffalo 3, N. Y.

TABER PUMPS for Higher Practical Performance

Pentachlorophenol can be mixed with inexpensive oils possessing characteristics which permit painting after the wood has been treated. Practically colorless in solution with light oils, it does not cover the grain and color of the wood. Dow makes the chemical.

65. Versatile Thickener

A SYNTHETIC, non-creaming thickener for natural and synthetic latex has been developed in the laboratories of American Polymer Corp., of Peabody, Mass. Known as Polyco 296, this new product is based upon acrylate copolymers and can be diluted with hot or cold water to provide higher viscosities at lower concentrations than most commercial thickeners.

Because of its unique chemical composition, Polyco 296 is not subjected to the rotting, scouring and mildewing usually encountered with naturally derived gums, proteins and starches. It will not support bacterial growth, is non-oxidizing, non-yellowing, stable in the presence of heat, and resists oils, fats, greases and aliphatic solvents.

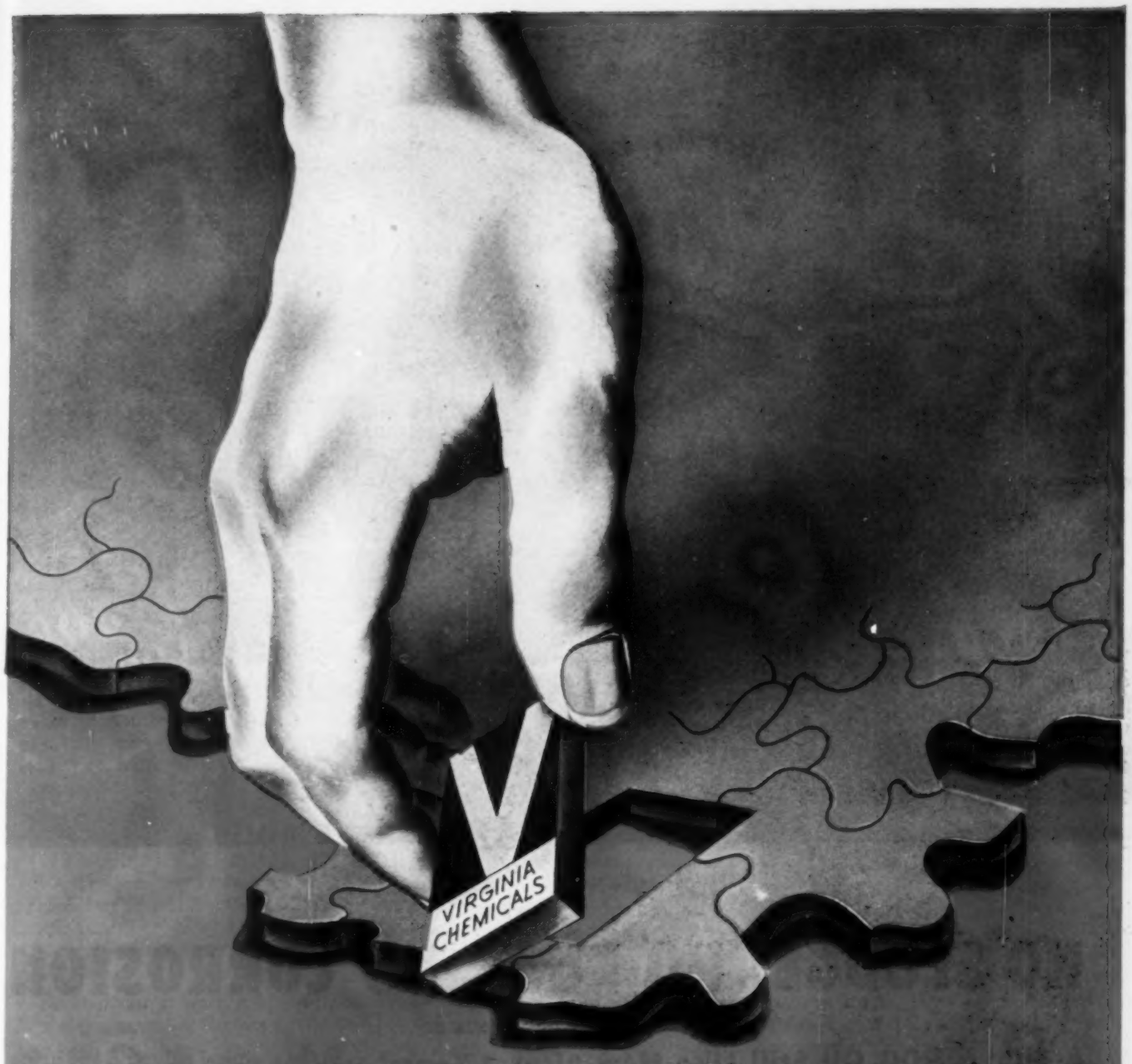
Polyco 296 is recommended as an additive to thicken latices and resin emulsions for textile printing, pastes and sizes. It also finds use in the manufacture of lubricating greases; in dipping, saturating and coating operations; as a flexible film former to render paper, leather and plastic films acid- and oil-resistant; and as a protective colloid for many types of emulsions and dispersions.

66. New Line of Dyes

A NEW line of dyes, Calconyl Double Solutions, has been introduced by the Calco Chemical Division, American Cyanamid Co. Calconyl Double Solutions are stabilized azoic dyes requiring acid-aging. They are recommended for cotton printing but can be used on viscose. The new line of yellows, reds and scarlet possess good brightness and economy in full shades.

The Calconyls produce heavy, bright shades of good fastness to light, washing, chlorine, perspiration, dry cleaning and hot pressing, and offer a wider range of shades in the same pattern than are obtainable when printing on naphthol-prepared material. It has been pointed out that they are satisfactory for use in patterns along with other acid-aging types of dyes such as soluble vats or resin-bonded pigments.

Stable under normal conditions, the Calconyls will not precipitate or separate on long standing in the color shop.



our know-how fits your problems

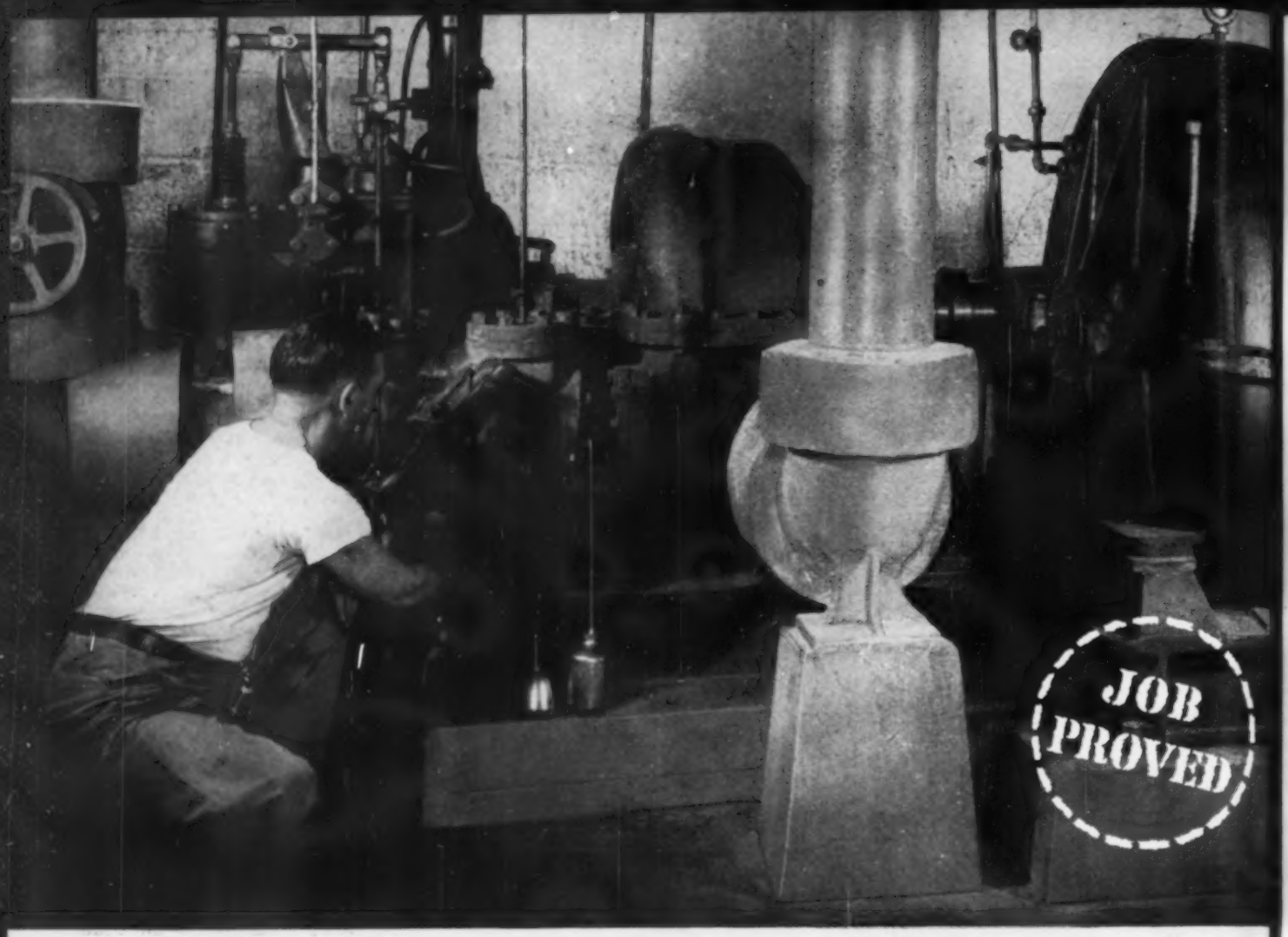
For 50 years, users of industrial chemicals here and abroad have looked to "Virginia" for products of uniform purity and excellence. More, they have relied heavily upon "Virginia's" versatile engineering staff for research and consultation in the perfecting of their products and processes. This technical cooperation is freely available to you. "Virginia's" vast experience, teamed with your own specialized knowledge, will find a ready answer to your problems.

Write today for literature descriptive of the varied properties and uses of the basic "Virginia" chemicals—Liquid Sulfur Dioxide (SO_2); Sodium Hydrosulphite ($Na_2S_2O_4$); Zinc Hydrosulphite (ZnS_2O_4); and Zinc Sulfate ($ZnSO_4$). These folders will prove most stimulating. VIRGINIA SMELTING COMPANY, West Norfolk, Box 21, Virginia.

VIRGINIA Chemicals

NEW YORK • BOSTON • DETROIT

50 YEARS OF SERVICE TO INDUSTRY



NO SLUDGE, NO RUST, NO CORROSION

A Sunvis 900 Oil Still Like New After 3 Years' Service—Gears and Bearings Show No Wear

Before restarting a turbine which had been idle for several years, a mill was determined to find the best lubricants obtainable. This costly equipment, vital to production, was to operate under severe conditions. After careful study, the grade of Sunvis 900 Oil recommended by a Sun engineer was selected for the circulating system and bath-lubricated reduction unit.

That was over three years ago. As yet, the Sunvis 900 Oil has not been changed, and makeup has been slight. Though unfiltered and untreated while in service, the Sunvis Oil remains sludge-free.

Temperature of operation has been kept down to 140° F. During the last two summers, the turbine was shut down and thus exposed to condensation. However, despite this intermittent operation, recent inspection proved the gears and bearings to be free of rust, corrosion and measurable wear. Regular service tests prove the oil still to be in excellent condition.

Sunvis 900 Oils are meeting the toughest lubrication requirements of the chemical industry, and doing a notable job. These top-quality lubricants give exceptional performance in enclosed gear boxes, where varying temperatures and loads call for superior stability. In fog-spray lubrication, where resistance to oxidation is a *must*, Sunvis 900 Oils are unsurpassed. They are ideal for circulating systems, since they are fortified against sludge and corrosion, and give exceptionally long life.

For more information about Sunvis 900 Oils, write for free illustrated booklet CE 10.

SUN OIL COMPANY · ***Philadelphia 3, Pa.***
In Canada: Sun Oil Company, Ltd.
Toronto and Montreal

SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

SUNOCO

MEN, MACHINES AND METHODS

Roger Williams, Jr., ASSISTANT EDITOR

T-H and the Commies

Here, in an authoritative article, is the first of two reviews of the Communist situation in chemical unions. This article tells why the Taft-Hartley anti-Communist affidavit is needed, how the courts have acted, and how you can handle unions which have not complied with the law.

OUSTING Communists and their sympathizers from key spots in American labor unions is a major aim of the Labor Management Relations Act. As a law of Congress, this stands as the official policy of our government until changed.

The Taft-Hartley labor law, of which we are speaking, is little more than a year old. Many of its provisions were carried over from the Wagner Act of 1935, which it amends. The Communist issue, however, is brand new.

No doubt, this bright spotlight swung suddenly on Communist union leaders by the T-H law raises questions in the minds of many new employers. They favored enactment of this law and don't want to let it down.

Speaking to so many employers, as this magazine does, we would not advise what you should do on this issue —if we could. Your situations vary, your problems differ. There's no single answer. Besides, this writer doesn't want to be responsible for any costly consequences which might flow from following our unsolicited advice.

But, it seems to us, it can be of help in your approach to the Communists-in-our-union problem if we examine some of the road we've traveled in the past year toward its correction.

We can best tell you what management should know about this phase of the labor-management-government relationship by answering three questions.

1. Why do we have an anti-Communist clause in the T-H law?
2. What are the rights and privileges of an employer, his employees or a union on this issue?
3. What has been the experience under this part of the law of employers, of individual workers and of unions?

1. Why the Clause?

When Congress passed the T-H law on June 23, 1947, over President Truman's veto, postwar friction existed between the U. S. and Soviet Russia.

Less than three weeks before, speaking to Harvard graduates, Secretary of State Marshall had proposed a European Recovery Program as an economic step toward halting Communist aggression in western Europe. It materialized in the four-year, global-aid program costing almost $20-billion.

The country stirred then, as it does today, with war fear.

In its hearings on the law, Congress heard testimony that, before the recent war, Communist union leaders called or prolonged strikes in some of our defense industries. The reason: To sabotage our armament program at a time when Joe Stalin played Hitler's tune. Strikes at Allis-Chalmers and North American Aviation were examples.

Congress was convinced, also, that Communist leaders put the interests of Soviet Russia ahead of the welfare of workers they ostensibly represent, as well as ahead of the good of our country.

Congress knew, furthermore, that the Communist technique for revolution is to work through the trade unions. The big unions and the Truman administration fought the T-H law tooth and nail. Yet John W. Gibson, assistant secretary of labor and former president of the Michigan CIO, spoke these words to a Congressional committee last March:

"The Communists, through their domination of the Czech trade unions, were able to manipulate them to such a degree that when the proper time arrived, the unions, organized as 'action committees,' worked in con-

Number of Unions and Union Officials in Compliance With the Communist Affidavit Requirements of the Taft-Hartley Law

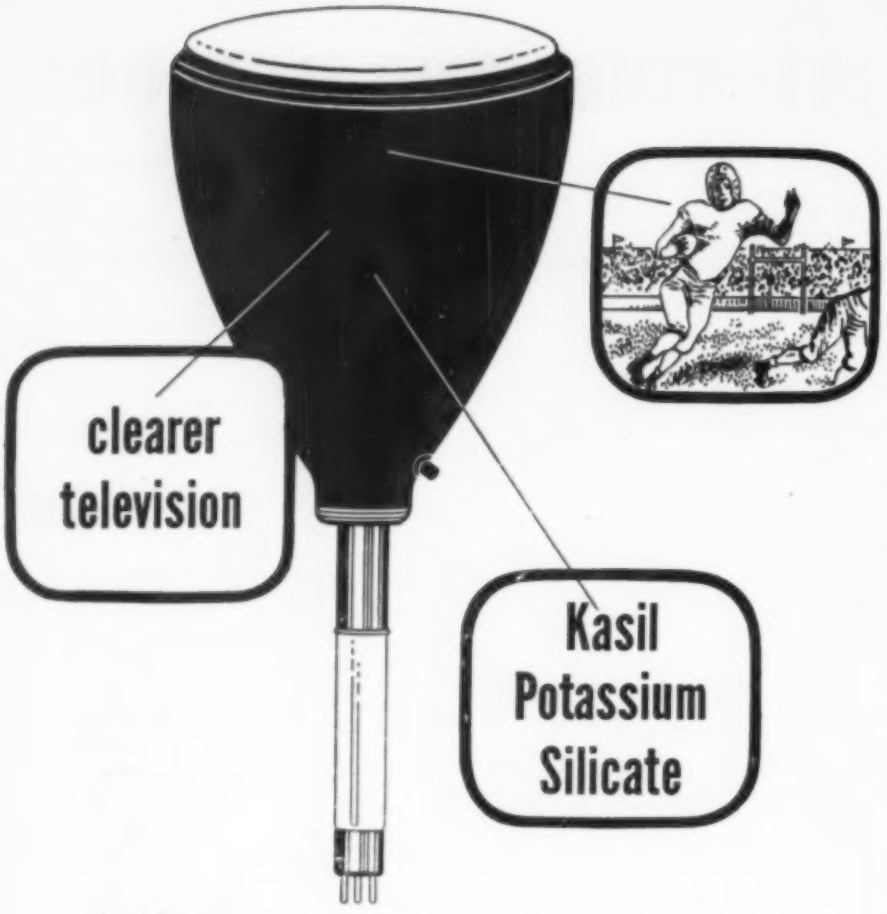
(As of Sept. 1, 1948)

National and International Unions		Local Unions	
Number of Unions		Number of Unions	
AFL	89	AFL	6,060
CIO	30	CIO	1,422
Independent	45	Independent	1,484
Total	164	Total	8,966
Number of Affidavits		Number of Affidavits	
AFL	1,066	AFL	53,921
CIO	268	CIO	13,541
Independent	539	Independent	12,618
Total	1,873	Total	80,080

The Author

Guest editor for this month, and next, is Joseph M. Gambatese, Washington Labor Editor of the McGraw-Hill Publishing Co. Gambatese has had long labor-relations experience. He left the job of labor editor of the Cleveland "Plain Dealer" to become chief of the Press Section of the National War Labor Board, a post which he held through the war. In the last three years with McGraw-Hill he has covered the Congressional passage of both the Case Bill in 1946 and the Taft-Hartley Law last year. He has studied and reported on all developments under the T-H law and has attended major union conventions to keep abreast of union policies and objectives. He recently covered the CIO Gas, Coke and Chemical Workers convention in Milwaukee.

—Roger Williams, Jr.



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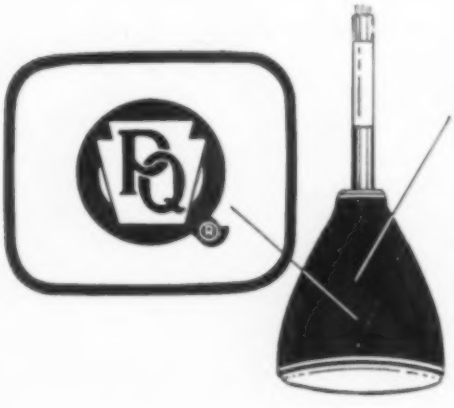

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junction with the Communist-controlled police to gain mastery over the country."

Congress doesn't want that to happen here. If armed conflict develops with Russia, Congress wants there to be no question about the loyalty of our unions and their leaders.

2. Rights and Privileges

What are the rights and privileges of employer, employee and union?

The whole subject of Communism is covered in one section—a single paragraph—in the T-H law. It is Section 9(h). It says that the National Labor Relations Board may not (1) "investigate" any representation issue raised by a union, (2) handle any union request for a union shop authorization poll, or (3) issue any union complaint against an employer—unless there is on file with NLRB an affidavit, not less than 12 months old, signed by each officer of the union and the officers of any national or international organization of which it is an affiliate. This affidavit must state that the union officer is not a member of the Communist Party or affiliated with such party, and "that he does not believe in and is not a member of or support any organization that believes in or teaches the overthrow of the United States Government by force or by any illegal or unconstitutional methods."

False statements are punishable under Section 35A of the Criminal Code. This puts a fine of $10,000 and/or imprisonment for 10 years against any person who makes a false statement to the government in seeking assistance.

This section, then, prohibits NLRB from giving assistance under certain other parts of the T-H law to any union whose local and national officers have not filed non-Communist affidavits. To be in compliance and eligible for NLRB help, unions must also meet the requirements of Section 9(f) and 9(g), which call for the filing of financial and organizational reports with the Labor Department.

Policy decisions of NLRB, and how the courts have looked at them in a few cases, illustrate the effect of this union compliance rule on your relations with a union, the union's relations with you, and the individual worker's relations with both you and the union. Let's look first at what you as an employer or manager can do.

If a union insists that you bargain with it, you may ask NLRB to hold an election. But if the union is not in compliance, NLRB will dismiss your plea.

Usually the union is seeking bargaining rights in your plant for the first time. But you can also take this step

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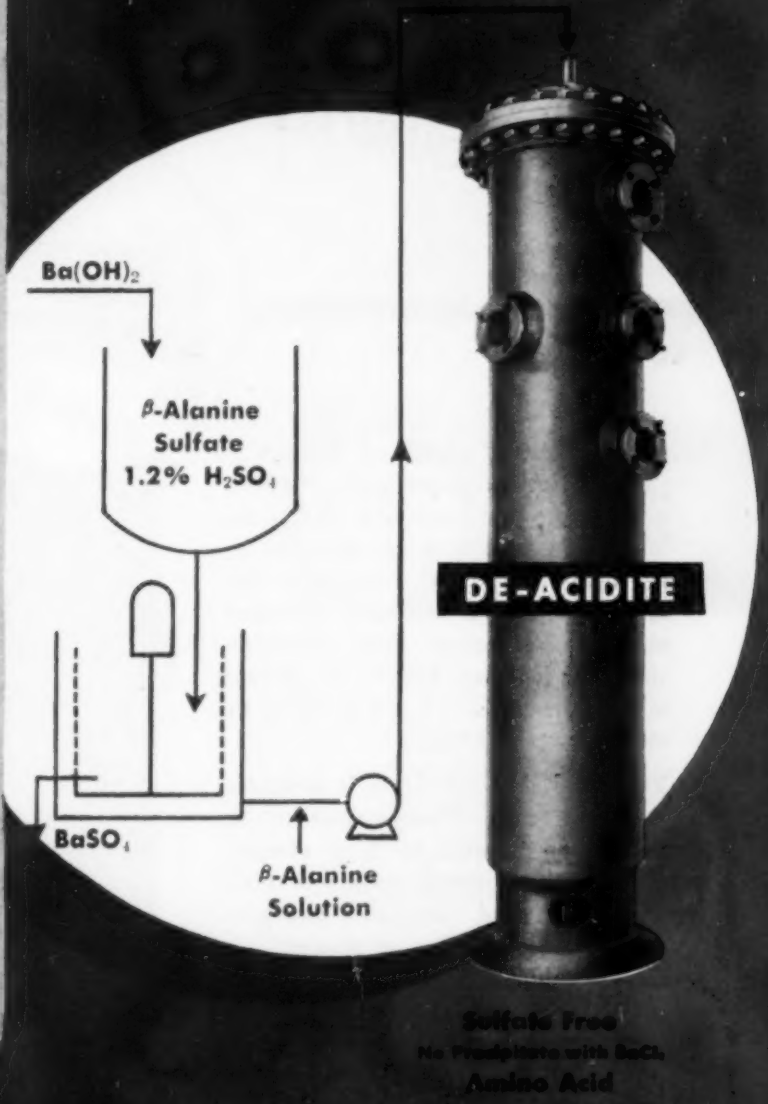

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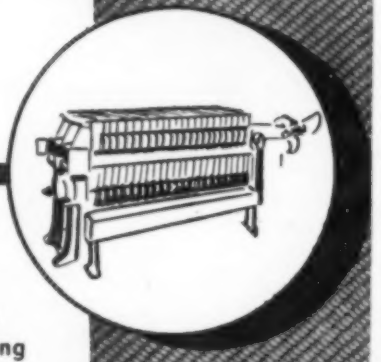

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when a current contract expires, as Remington-Rand did.

Sometimes you are confronted with recognition demands from two unions, and only one is in compliance, as happened to Herman Lowenstein, Inc. Lowenstein went to NLRB, which conducted an election with only the complying union's name on the ballot.

While you may bargain with a non-complying union, NLRB can't compel you. But it will prosecute to the end, as it did against Marshall & Bruce Co., any non-complying union's unfair labor practice charge (except refusal to bargain) if NLRB had issued a complaint against you before T-H took effect.

The risk of refusing to bargain with such a union is a possible strike to force recognition outside the law through economic pressure. The union risks losing the strike, and such strikers can be replaced, thus losing their jobs.

You, as an employer, are free to press charges against non-complying unions. A union striking for recognition, for instance, violates Section 8(b)(4)(B), which makes it an unfair labor practice for a union to force an employer to bargain with it unless it has been certified as the bargaining agent.

You may charge a non-complying union with refusing to bargain in good faith and NLRB may get an injunction against this refusal. That's how President John L. Lewis of the United Mine Workers, who has not signed a non-Communist affidavit, was made to settle with the captive coal operators.

The International Typographical Union, most active in defying the T-H law, has been prosecuted successfully through NLRB and the courts for its insistence on closed shop conditions in its contracts.

While you may, if you wish, deal with a non-complying union, your freedom is circumscribed in one respect. You may not make a contract which requires a worker to join or retain union membership as a means of keeping his job. Such contracts are permitted by the T-H law only if authorized by a majority of the employees under a so-called "union shop poll" conducted by NLRB. Since NLRB cannot conduct such elections for non-complying unions, they are not entitled to that type of union security contract. Closed shops, under which the employer hires only persons already union members, are illegal.

What about the individual worker? The T-H law goes all the way in protecting his rights irrespective of the status of his union.

An individual employee may accuse you of an unfair labor practice, such

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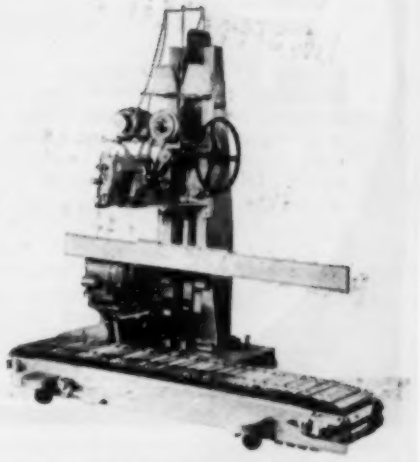

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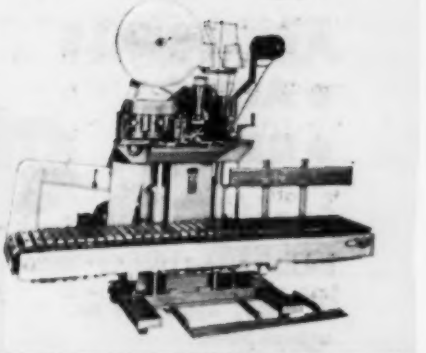

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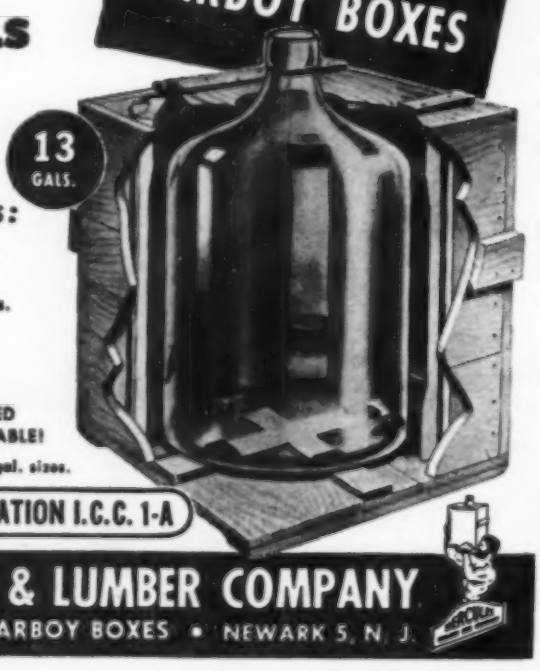

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as dismissal for union activity, even though the union involved is not in compliance with the law. In a matter involving Augusta Chemical Co., a trial examiner of NLRB has just held that the non-complying United Construction Workers, an affiliate of UMW's District 50, may assist such individuals in pressing their unfair dismissal claims. This view is subject to review, however, by the Board proper.

Besides being able to protect himself against discrimination by the boss, Joe Doakes can say plenty about what union, if any, shall represent him.

He can file an election petition with NLRB without signing a non-Communist affidavit (Acme Boot Co.). And if it's for the purpose of removing a union already in the plant, NLRB will put the union's name on the ballot for the purposes of decertification even though it is not in compliance and would not otherwise be entitled to a place on a ballot (Harris Foundry & Machine Co.). If the union wins, NLRB will not recertify the non-complying union, but will simply announce the election results.

A worker or other individual may be certified as bargaining agent for a group of workers, but he cannot "front" for a non-complying union. NLRB blocked the attempt of a recently-resigned official of such a union to obtain a place on the ballot at Campbell Soup Co.

The opposite situation developed at Solvay Process Division of Allied Chemical & Dye Corp. in Detroit. An employee became provisional officer of a new local of District 50 two weeks after filing a petition seeking decertification of the CIO Gas, Coke and Chemical Workers as bargaining agent. NLRB accepted his petition, explaining that there was insufficient evidence to find that he acted as an agent of District 50.

Employers or their supervisors may not file petitions to decertify a union. But NLRB will accept, as it did at Goodyear Tire & Rubber Co., a removal petition filed by an employee who recently stepped down from the supervisory ranks. That is, if there is no connection between the shift in status and the action against the union.

Non-complying unions get no "break" under the T-H law. NLRB has resolved every doubt against them.

We've already covered considerable ground in the discussion of employer and individual rights. Unions not in compliance may not file either election petitions or unfair practice charges, yet they may be made the target of removal proceedings or an unfair labor practice accusation. This means they get no advantage over a union that has qualified for use of

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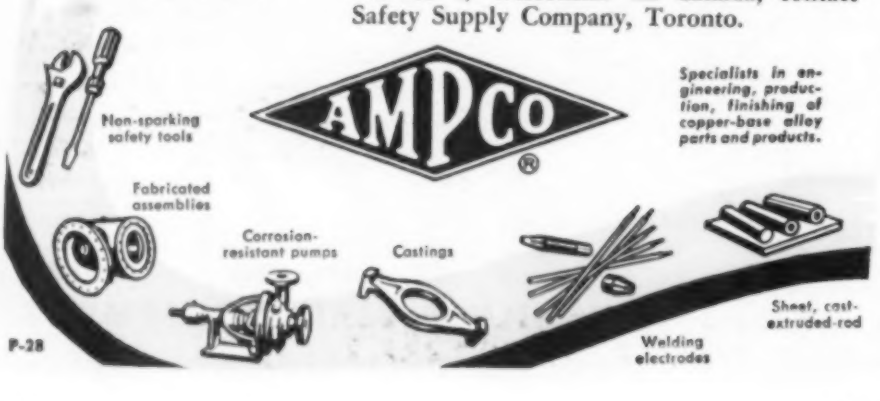

NLRB machinery. They may be hit with injunctions, obtained by NLRB, against secondary boycotts, featherbedding, jurisdictional disputes and all the other bad practices.

NLRB will not permit a national union to "front" for a non-complying local. The chemical industry provided the basis for this rule when the Board denied an election to the CIO chemical workers at a U. S. Gypsum Co. plant because a newly-established local had not yet complied.

A non-complying union may not intervene in an election hearing, initiated by a qualified union, unless it has a "contractual interest" in the matter. At Precision Castings Co., for instance, the non-complying CIO smelter union, whose contract had just expired, was denied a voice in NLRB's determination of whether the CIO auto union could replace it as bargaining agent.

Nor may a non-complying union get on an election ballot as an intervenor.

The courts have spoken in two cases involving the non-Communist affidavit rule. In both, the lower courts upheld the constitutionality of this provision.

One, involving the National Maritime Union's failure to be placed on the ballot because of non-compliance, went to the U. S. Supreme Court. It refused to review the Communist-oath rule after finding that the NMU was not entitled to be on the ballot anyhow because it had not registered with the Labor Dept. under Sections 9(f) and 9(g), which the court found to be constitutional.

In the other, involving a bargaining election at F. W. Woolworth Co. in New York, a three-judge Federal statutory court upheld the affidavit requirement in a split 2-1 decision. NLRB granted an election to the AFL Teamsters Union, leaving the CIO Wholesale and Warehouse Workers, Local 65, off the ballot, although it had held bargaining rights. The workers voted 155-146 against the teamsters.

A third case built especially to test this provision of the law is in the U. S. Circuit Court of Appeals in Chicago. CIO President Phil Murray has appealed a decision of NLRB that the Inland Steel Co. must bargain with the steel workers union on pensions only if the union's officers file the necessary non-Communist oaths. The union has met all other requirements of the law so that a clear decision may be obtained on this one point.

3. Experiences

Experience under non-Communist affidavit rule has been varied.

Some employers have stood their

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ground, insisting that they will not deal with a union not in compliance. At Remington-Rand, the workers did not strike, continued to work without a contract. At other plants, the unions struck, then gave up, some of them losing out to complying unions which stepped into the breach.

Sometimes the employer is helpless. Du Pont's experience at Belle, W. Va., is an example. District 50 had a contract. The CIO chemical workers petitioned for bargaining rights and was granted an election by NLRB. Not being in compliance, District 50 was not on the ballot. It urged its members to vote for "no union" and the CIO lost the election by a close margin, 1,616-1,551. Result: District 50 claimed that all the "no union" votes were votes for District 50, and that Du Pont should continue to bargain with District 50. When Du Pont refused, District 50 engaged in a violent strike that caused the governor to send state police to preserve "law and order."

In some cases, employers have been willing to continue relations with a non-complying union, but without a signed contract.

The great majority of employers, however, have not made an issue of the compliance question, especially where one of two factors exist:

1. There is no doubt that the union does represent a majority of the workers, even though it is a left-wing union. We point to the new contracts signed with the CIO electrical workers by Westinghouse, General Electric, General Motors and others.

2. The union is not under Communist influence, and its officers probably have not signed non-Communist affidavits on principle. Outstanding in this category are the many employers in the steel and coal industries who have not raised this issue.

Most unions have learned the wisdom of filing non-Communist affidavits and using the Taft-Hartley law to their advantage. The number in compliance has increased every month. As of Sept. 1, all but a handful of the 105 AFL and 44 CIO unions were using NLRB services.

Some, like the musicians, barbers and railroad workers, do not use NLRB and therefore would have no reason to comply. Eleven left-wing CIO unions are out of the fold because their officers apparently cannot sign affidavits without risking prosecution.

Then there are the three big unions, with no taint of Communism, whose officers oppose signing affidavits on principle. They are the United Mine Workers, the United Steelworkers and the ITU.

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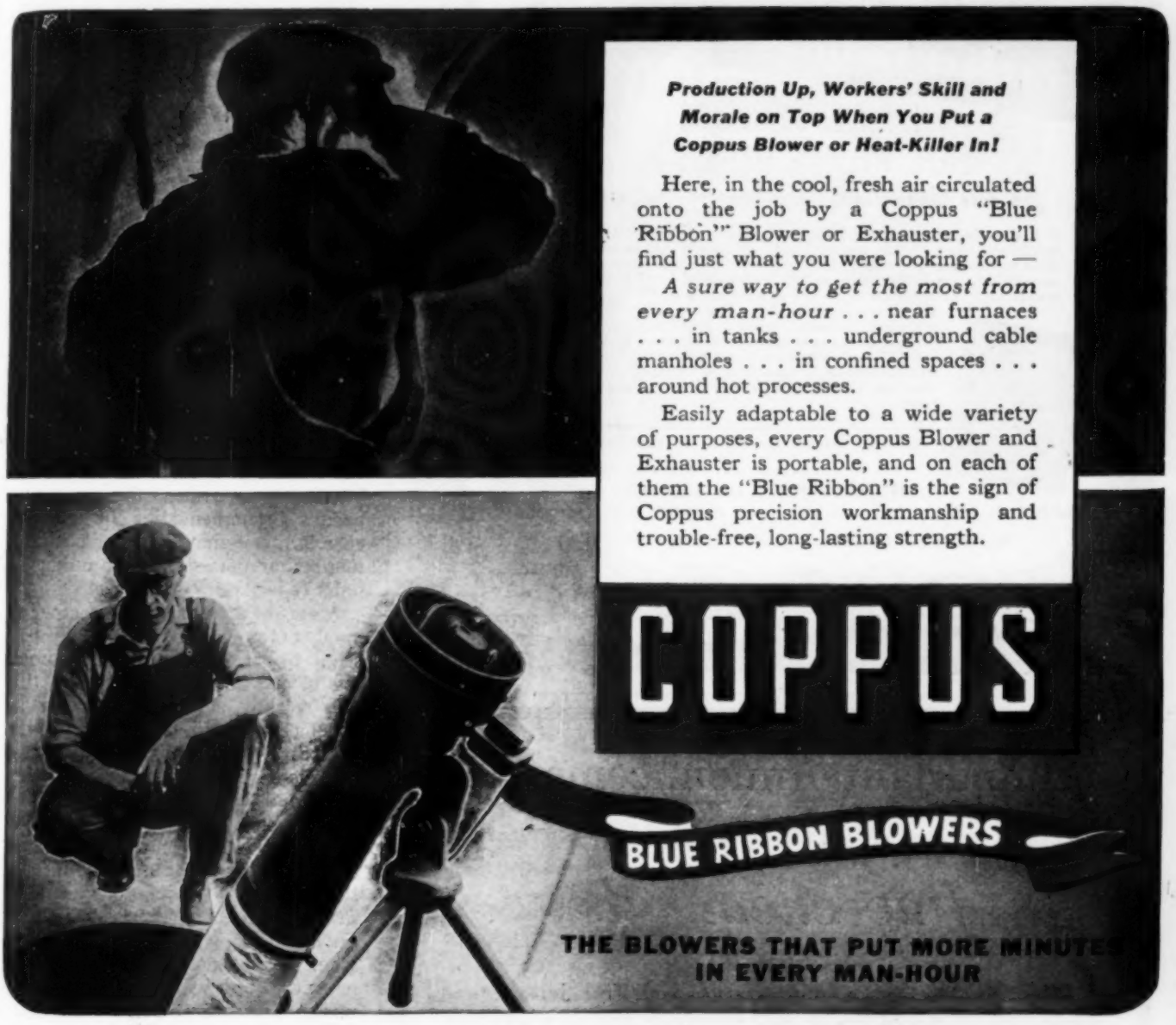

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Easily adaptable to a wide variety of purposes, every Coppus Blower and Exhauster is portable, and on each of them the "Blue Ribbon" is the sign of Coppus precision workmanship and trouble-free, long-lasting strength.

COPPUS

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 230 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
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- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
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- ☐ general man cooling
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- ☐ exhausting welding fumes:
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

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(Write here any special ventilating problem you may have.)

MACHINED ENDS
Assure
Perfect Welding
169
P.P.&E.CO.
347
P. P. & E. STAINLESS
STEEL WELDING FITTINGS . . .
for All Corrosion-Resisting Applications
It is possible to construct any stainless piping system with a minimum of equipment, using P.P.&E. fittings, simply by straight cutting of tubes, and plain butt welding. The ends of all P.P.&E. fittings are accurately machine tool cut—fittings of wall thickness over .083" are beveled to 37½° with approximately 1/16" straight face; those with wall thickness of .083" or lighter are cut straight, not beveled. Consequently, fitting time is minimized, and faster, uniformly sound welds are assured.
These fittings, manufactured in Stainless Types 304, 316, and 347, are available to match pipe and tubing of various wall thicknesses in sizes from ¾" through 12". They are annealed, blasted, and passivated for maximum corrosion resistance.
The Most Complete Line of Stainless Steel Welding Fittings
STAINLESS ALLOY DIVISION
PITTSBURGH PIPING and EQUIPMENT COMPANY
10 43rd Street · Pittsburgh, Penna.
Send for Catalog S-309
World's Largest Manufacturer of Stainless Steel Welding Fittings

Important Announcement
to users of
fine chemicals

PARAGON Testing Laboratories, Orange, New Jersey, producers and refiners of fine organic chemicals, has been acquired by The Matheson Company, Inc. of East Rutherford, New Jersey and Joliet, Illinois. The business is being continued as the Paragon Division of The Matheson Company.

The high standards of quality set for Paragon Fine Organic Chemicals will be rigidly maintained. Furthermore, a change in the method of packing, using two standard sizes for all chemicals, now enables us to speed delivery.

A new price list on our present line of 1500 fine chemicals has just been published. If you have not received your copy, write for it today.

PARAGON DIVISION
THE MATHESON COMPANY, INC.
East Rutherford, N. J. Joliet, Illinois

the non-complying unions have been hit hard because of their failure to comply with this part of the law. The left-wing CIO unions have been ripped by those in the CIO "right" that have taken advantage of the non-compliance handicap of the left-wingers. The steel workers have not been raided, but have not been able to capitalize on some of their gains. At Nashville Corp., for instance, where the Machinists Union had a contract, the steel union scored a victory in an NLRB election two days before the T-H law took effect. But it could not be certified, and the prospective 1,000 members went back to the other union.

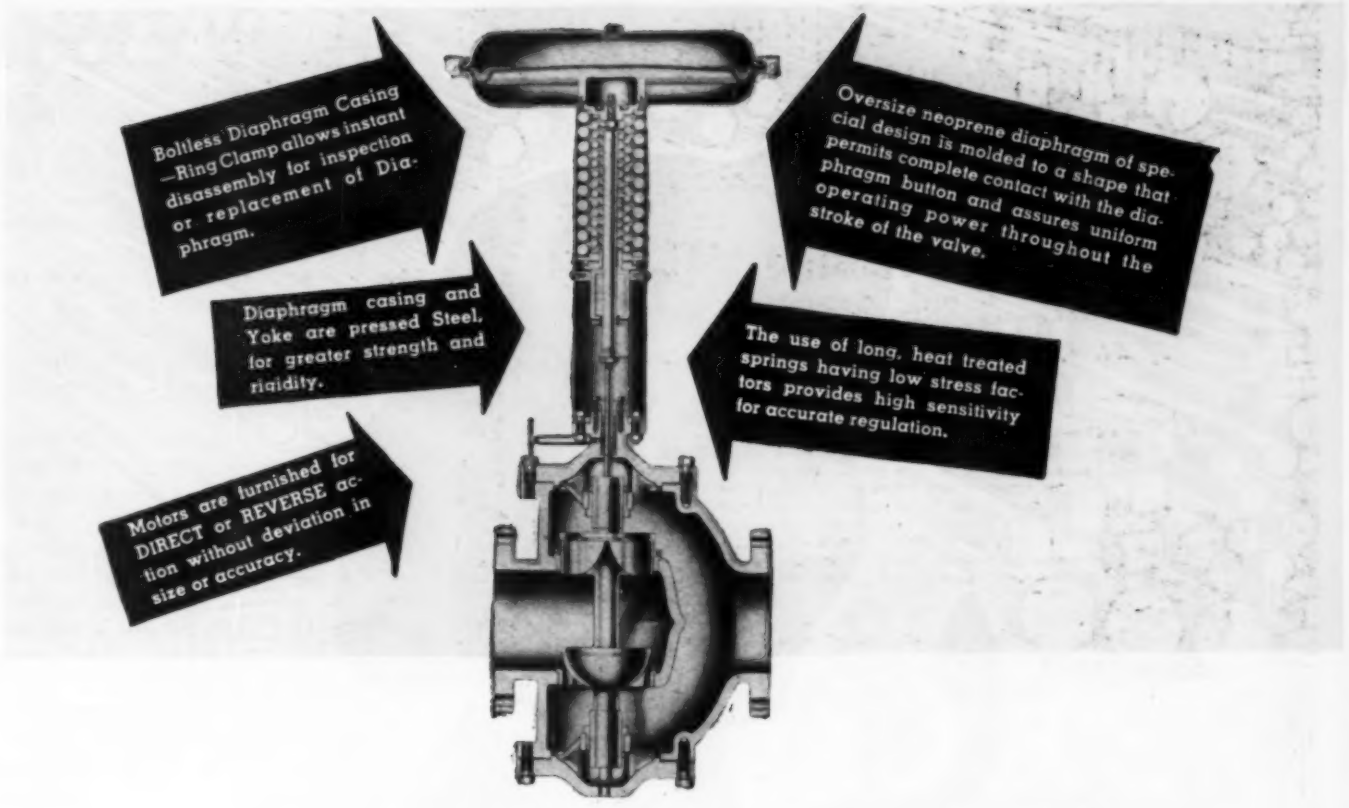
Considerable change has occurred within unions because of the national policy on Communist union officials. Some left-wing unions have seen large blocs of locals walk out and join up with a union in compliance. Some officers have resigned, many were fired, because they could not or would not swear an oath against Communism. One convention—the CIO Furniture Workers – overruled the executive board's recommendation for compliance. Other unions have reduced the number of offices in their union in order to facilitate compliance.

More heartening, is the growing number of unions taking it upon themselves to ban Communists from holding office. The steel union did this only recently, although it won't make its officers file similar oaths with the NLRB. The CIO chemical and glass workers have also taken steps to keep Communists out of union positions.

The trend, however, has been to get under the NLRB tent. More unions are complying every month. Murray's steel union is holding out while it makes the court test, but you can look for it to comply, too, if the Supreme Court upholds the requirement. If that happens, Lewis will also consider complying if his District 50 runs into difficulty for lack of compliance.

If the affidavit rule stands up, as it has in two courts already, the various applications of the rule outlined above will have more meaning in your future relationships with unions. The position you take in a given situation may be very costly to your company. It may be contrary to public policy, if not illegal. A decision to wink at the law may offer temporary advantages, but may also tread heavily on the individual rights of your loyal employees.

Today many things must be considered when planning the next move in labor relations. High on the list is the type of union and union leaders pounding on the bargaining table. You should know the unions in the chemical industry better. Next month we'll take a look at some of them.


Boltless Diaphragm Casing —Ring Clamp allows instant disassembly for inspection or replacement of Diaphragm.
Diaphragm casing and Yoke are pressed Steel, for greater strength and riaidity.
Motors are furnished for DIRECT or REVERSE action without deviation in size or accuracy.
Oversize neoprene diaphragm of special design is molded to a shape that permits complete contact with the diaphragm button and assures uniform operating power throughout the stroke of the valve.
The use of long, heat treated springs having low stress factors provides high sensitivity for accurate regulation.

Modern, Unhampered Engineering Developed this Modern Diaphragm Control Valve!

Modern processes have constantly called for improved control valve performance at higher operating temperatures and pressures. Kieley & Mueller demanded of their engineers thinking and design that would keep pace with the era of Instrumentation.

Existing design, pattern equipment and production methods were disregarded, and the NEW Kieley & Mueller line was evolved. Its enthusiastic reception is the best indication of how well it fills the requirements of modern processing!

The COMPLETE Kieley & Mueller line contains many design advances for closer regulation, easier maintenance in the Automatic Control of Pressures, Flows, Temperatures and Liquid Level. For specification data, write for Catalog 47.

Contents — Kieley & Mueller Catalog 47

Kontrol Motor Diaphragm Valves—Saunders Patent Diaphragm Valves—Direct and Reverse Acting Diaphragm Motor Top Works—Accessories—28 pages.

Pilot or Direct Operated Liquid Level Controls—Float Valves—Balanced Lever Valves—Ball Float Drainers—30 pages.

Strainers—4 pages.

Pressure Reducing Valves—Auxiliary Pilot Regulators—Pump Governors—36 pages.

Steam Equipment—Back Pressure Valves—Atmospheric or Diaphragm Relief Valves—Stop Check Valves—Exhaust Heads—Grease Extractors—16 pages.

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NORTH BERGEN, N.J.

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Our Business is YOUR Business

You can simplify steel purchasing for every chemical processing requirement with a call to your nearby Ryerson plant. We plan our stocks to meet your needs and, when it comes to steel, our business is your business.

For more than a hundred years Ryerson specialists have been working with the nation's industry—quickly supplying the right steel for every application. Now, during times of great demand, Ryerson stocks and Ryerson experience are especially helpful.

Whether your requirements are measured in pounds or tons, they receive the immediate attention of well-qualified steel men. And when the product you need is not readily available from stock, Ryerson know-how goes to work. Often we can suggest a practical alternate.

So contact Ryerson when you need steel for new construction or maintenance. Let one order to Ryerson, one invoice and one shipment do the job; save you time and money.

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

PRINCIPAL PRODUCTS

STAINLESS—Allegheny metal sheets, plates, tubing, etc.
BARS—Carbon & alloy, hot rolled & cold finished
STRUCTURALS—I beams, H beams, channels, angles, etc.
PLATES—U.M. & sheared Inland 4-Way Floor Plate
SHEETS—hot & cold rolled, many types & coatings
TUBING—Seamless & welded mechanical & boiler tubes

RYERSON STEEL

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

Houston Maps Plans for a Survey of Its Chemical Process Industries

A SURVEY of the chemical processing and allied industries, and of petroleum refining operations, along the Gulf Coast is being made by the Houston Chamber of Commerce. Questionnaires have been mailed to companies along the coast from Lake Charles, La., to Brownsville, Tex. It is expected that results of the survey will be published before July of next year. Up to September 15, about 25 percent of the companies surveyed had filed their replies.

The purpose of the investigation is to determine the relative positions of the chemical manufacturing and petroleum refining industries in the manufacturing economy of the Coastal Southwest. These positions will be determined with reference to similar surveys which the Chamber of Commerce's Manufacturing Division of the Research and Statistics Committee is making in other Coastal industries. S. S. Emison, Consolidated Chemical Industries, is chairman of the Manufacturing Division.

Full details of the information on chemical and petroleum refining operations which will be reported have not yet been entirely developed. It is uncertain as to what extent information on individual companies can be released. The Research and Statistics Committee hopes that arrangement can be made with the companies to disclose the various products which each manufactures.

Requested information includes: estimated value of plant investment at the end of 1947: estimated cost of plant expansion for the period 1947-1948; total number of employees; total monthly payroll; types of products manufactured; types of raw materials used from the Coastal and other regions; total sales, all products, during 1947.

Other industrial groups which remain to be surveyed include manufacturers of chemical and petroleum industry equipment; stone, clay and glass products; wood products; and paper and paper products.

Shell Dedicates New Glycerine Unit

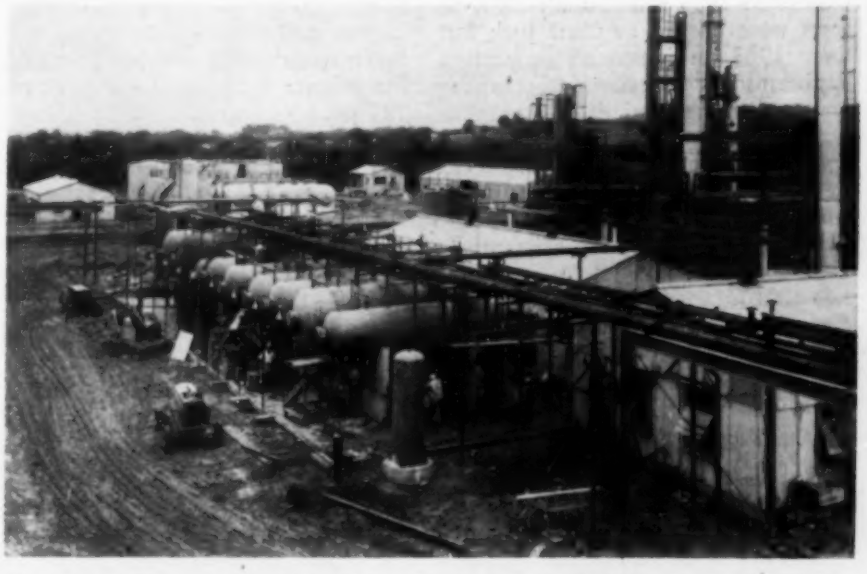
SHELL CHEMICAL CORP. played host to several hundred visitors in the course of a two-day celebration during September 16 and 17 in connection with the dedication of the company's new synthetic glycerine plant at Houston, Tex. Among those in attendance were industrial executives, technologists, educators and federal and state officials. Included in the list of those representing Shell Chemical Co. and its affiliates were members of Shell Development Co., which developed the process embodied in the plant.

Entertainments included a barbecue on Vernon W. Frost's Pecan Acres ranch outside Houston, at which "ten-gallon" cowboy hats were distributed to the guests; a boat trip down the Houston ship channel, along which are situated the Shell Chemical and Shell Oil Co. plants; a plane tour of the industrial area around Houston, Freeport, Beaumont and Port Arthur; a luncheon aboard the battleship Texas berthed at the San Jacinto battle grounds near Houston, and in inspection of the glycerine plant and other facilities of Shell Chemical.

Speakers for the dedication were B. M. Downey, Shell Chemical plant manager, master of ceremonies; Dr. W. V. Houston, president of Rice Institute, who formally announced the opening of the plant; and Jan Oostermeyer, president of Shell Chemical Corp., who spoke in the official acceptance of the plant from Dr. Houston.

Stanolind Clarifies Story On Garden City Plant

CONSTANTLY rising materials and labor costs have driven Stanolind Oil & Gas Co. to postpone for an undeter-



Bureau of Mines coal-hydrogenation plant nears completion at Louisiana, Mo. Bechtel Corp. plans to complete the $7 million demonstration plant this year. The company plans to make some test runs this month.

mind time its projected $80,000,000 plant at Garden City, Kan., for the conversion of natural gas into synthetic gasoline, fuel oils and organic chemicals.

Up to the time of the announcement several weeks ago the company had advanced as far as clearing the site, road construction and foundation testing.

That the project has not been abandoned was indicated in the subsequent statement by a construction company that it will proceed in the building of a large number of dwellings near the plant site which would be occupied by operators of the plant.

Stanolind officials have denied a rumor that they have decided to build the installation in New Mexico instead of Kansas. They say the same considerations leading to delay of work in Kansas would operate equally with respect to any other site.

The company says that no change is contemplated in its other construction projects, which include the chemicals plant at Brownsville, Tex., and the natural gasoline plant at Ulysses, Kan.

Standard of Indiana Signs New Contract With Carbide

STANDARD OIL CO. (Indiana) will supply billions of cubic feet of hydrocarbon gas, valued at approximately $75,000,000, from its Whiting, Ind., refinery to the adjacent chemical plant of Carbide and Carbon Chemicals Corp., under terms of a new 15-yr. contract which has recently been drawn between the two companies, a company announcement stated today.

Prior to 1935 substantially all such gases were burned as plant fuel; but since 1935 an increasing proportion has been sold to the chemical company for use as raw material in the production of a variety of chemicals, principally acetone, acetic anhydride, and alcohols. Under the new agreement, which will extend to 1965, the volume of gas delivered will be substantially greater than heretofore and will permit a sizable expansion of the production facilities in the Carbide plant.

Pan American Oil Plans to Expand at Texas City

PAN AMERICAN REFINING CORP. has announced a large building program for its refinery at Texas City, Tex. D. J. Smith, president, says that in view of constant advances in petroleum refining technology "it is necessary not only to turn over to research our present administration building, but to rebuild and enlarge this building to house our research laboratories."

The program calls for a new administration building and a rebuilt and enlarged laboratory. The administration building will be a two-story brick structure of 279 by 101 ft., and will be air conditioned. An auditorium in the building will be used for staff meetings and training programs for employees.

The present administration building, which will be rebuilt for the engineering and research personnel, will be changed to include a three-story process laboratory.

General contractor is the H. K. Ferguson Co., Houston.

Hammond Site of Modern Swift Fatty Acid Unit

OPERATIONS will begin this fall in a new industrial oil processing plant at Hammond, Ind., that will add new sources of glycerides and fatty acids to the oil production of Swift & Co., according to E. A. Moss, vice president.

This new plant will include units to carry out solvent crystallization, solvent fractionation, and fat splitting. By these processes Swift will get improved products of uniformity in quality, and in quantities sufficient to fill the requirements of mass production industries.

The fat splitting unit in the new plant is a continuous hydrolysis unit constructed by Blaw-Knox. It is a continuous high temperature hydrolysis employing countercurrent reaction in a pressure tower with internal heat exchange. In the unit, the fat is introduced into the splitting column at the bottom and water at the top. These two materials react countercurrently in the column at about 500 deg. F. and 725 psi.

Heat exchange between fatty acid and water takes place in the top portion of the column and between fat and sweetwater in the lower portion. A rapid splitting takes place and the reaction products are continually removed—the fatty acids and a small quantity of water from the top of the column and the glycerine sweetwater from the bottom. Heat required to maintain the contents of the column at operating temperature is supplied by direct high pressure steam.

The solvent fractionation process at Hammond is to be carried out in a unit being built by M. W. Kellogg Co. employing their Solexol process recently introduced into the glyceride oil industry. The process employs propane as a solvent and operates at pressures sufficient to maintain the propane in a liquid state at temperatures below 206 deg. F.

By the varied fractionations which can be carried out, drying oils, vitamin concentrates, and relatively pure fatty fractions of high quality can be produced.

The third process, solvent crystallization or destearination, will be carried out in a unit also being constructed by M. W. Kellogg. Solvent crystallization is a process for low temperature fractionation of fatty materials. In the unit being installed, feed stock is taken up with propane and the solution is then chilled until the higher melting fraction is crystallized. The slurry of crystallized fatty materials and liquid propane solution of the uncrystallized oil is then fed to a continuous filter where the fatty crystals are removed. The liquid and solid fractions are then stripped free of solvent.

Dorr Making Movie of European Installations

DR. JOHN V. N. DORR, president of the Dorr Co., and Mrs. Dorr have returned from Europe. Dr. Dorr went over to visit his associated companies and agencies in Europe and to attend with Mrs. Dorr the annual meeting of the Society of Chemical Industry at Edinburgh, Scotland.

Mrs. Dorr, who is producing a colored motion picture film "The Story of the Dorr Company" has as her assistant, Mrs. Erica Anderson, whose industrial and documentary films are well known. They took this opportunity to "shoot" Dorr-Oliver installations and personnel throughout Europe, travelling over 5,500 miles by station wagon and shooting from Sweden to Venice with a party including staff members of the associated companies.

Dr. Dorr reported that he found in all countries visited enthusiastic workers, recognizing the cloud hanging over the world but realizing that cooperation and hard work was the best insurance against disaster and feeling that with America with them the world could be made safe.

Shell Chemical Offices Move to New York

ADMINISTRATIVE offices of Shell Chemical Corp., moved from San Francisco last month to a new building at 4 West 58th Street, New York, according to Jan Oostermeyer, president. The company manufactures and markets petroleum-derived chemicals

TYPE SES

Ball bearing unit pillow block—assembled and lubricated. Rubber-mounted for quiet operation.

TYPE SUS

Self-aligning ball bearing unit pillow block—with ring seals to exclude dirt.

Meet THE SKF FAMILY OF PILLOW BLOCKS

TYPE SUA

Self-aligning ball bearing unit pillow block adapter mounting. Furnished assembled and lubricated ready for easy installation. Ring seals exclude dirt. TYPE SUAR—Same pillow block equipped with spherical roller bearings.

TYPE SAF

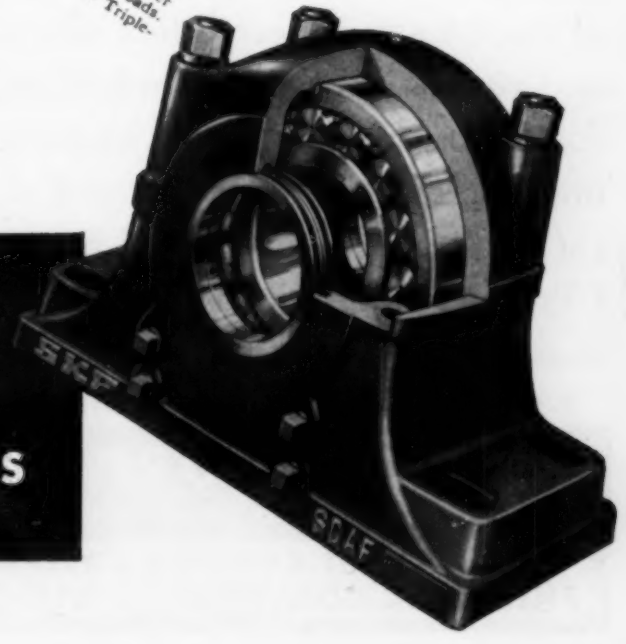
Supplied with either self-aligning ball bearings or spherical roller bearings with adapter mounting. Bearings protected with SKF Triple-Seal rings. TYPE SA—Same unit using felt seals.

How often are you confronted with the question, "Shall we use a ball or roller bearing pillow block?" The SKF line can handle ALL jobs—the BIG jobs, the *little* jobs, the in-between jobs—with pillow blocks equipped with either ball or roller bearings to handle the known loads, speeds and operating conditions of *your* job. Authorized SKF Distributors carry pillow blocks in stock. Send for Catalog 280, second edition. 6452

SKF INDUSTRIES, INC., PHILA. 32, PA.

TYPE SDAF

Exceptionally heavy and rugged pillow block with self-aligning spherical roller bearings for severe loads. Equipped with SKF Triple-Seal rings.



SKF PILLOW BLOCKS

If the production losses, direct and indirect, caused by dust could be computed it would amount to a staggering figure each year. DRACCO Dust Control creates better working conditions — reduces the cost of maintenance and prolongs the life of equipment, general plant efficiency is improved and results in greater production. Good working conditions attract better workers. Even a small amount of dust is costly and should be given serious consideration. Why not consult DRACCO Engineers? They have over 30 years experience in dust and fume control.

For Further Information Write

DRACCO CORPORATION

4071 E. 116th St., Cleveland 5, Ohio *New York Office:* 130 W. 42nd St.

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

and chemical intermediates for a wide variety of industrial and agricultural uses.

Approximately 115 administrative and staff employees and their families were involved in the move from the west coast offices. The company's western sales division office will remain in San Francisco.

From the New York office, Shell Chemical will continue to direct the operation of its plants in Houston, Tex., and in Martinez, Dominguez, and Pittsburg, Calif.

International Reports on Activities for Fiscal Year

THE International Minerals and Chemical Corp. has reported net earnings of $5,016,028 after all charges for the fiscal year ended June 30, 1948, as compared with $3,826,992 for the previous fiscal year. Net profits per common share for the year were $5.85 on the 789,780 shares outstanding, as compared with $4.35 per share last year on the 788,155 shares then outstanding.

"For the fourth year in a row sales and earnings have exceeded the previous year's records," Louis Ware, president of the company, said. He added that it is encouraging to note how well

CONVENTION CALENDAR

American Society for Quality Control, third Midwest conference, Sherman Hotel, Chicago, Ill., November 4-5.

American Institute of Chemical Engineers, annual meeting, Pennsylvania Hotel, New York, November 7-10.

National Paint, Varnish, and Lacquer Association, Congress Hotel, Chicago, November 8-10.

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, November 8-11.

American Oil Chemists Society, fall meeting, Pennsylvania Hotel, New York, November 15-18.

Industrial Hygiene Foundation, annual meeting, Mellon Institute, iPttsburgh, November 17-19.

18th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, November 29-December 4.

Society for Experimental Stress Analysis, annual meeting, Hotel Commodore, New York, December 2-4.

Synthetic Organic Chemical Mfrs. Assn., annual meeting, Hotel Commodore, New York, December 8.

Chemical Market Research Association, winter meeting, Toronto, December 9.

American Society of Heating and Ventilating Engineers, 9th International Heating and Ventilating Exposition, International Amphitheater, Chicago, January 24-28.

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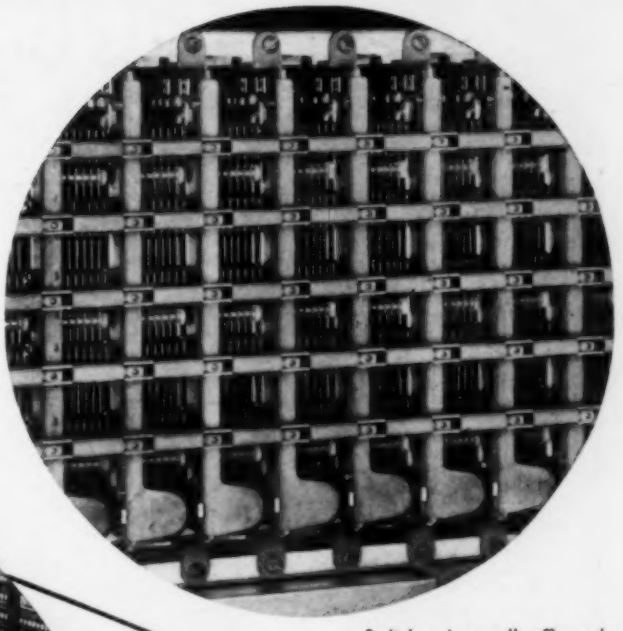


Switches in small offices do a distant operator's bidding.

IT TALKS WITH FINGERS

For those who want to talk, Bell Laboratories scientists developed the telephone. For those who prefer the typewritten message, they developed TWX – Teletypewriter Exchange Service.

Fingers on a keyboard send your message to be typed by one or scores of other teletypewriters selected at your request from the 21,000 instruments connected to the Bell System's nationwide TWX network.

As in telephone service, your TWX connection is set up through switching systems, manual or mechanical, as best may serve. And over long distances your message travels economically with many others on the same pair of wires. All these technics are products of Bell Telephone Laboratories research in the telephone art.

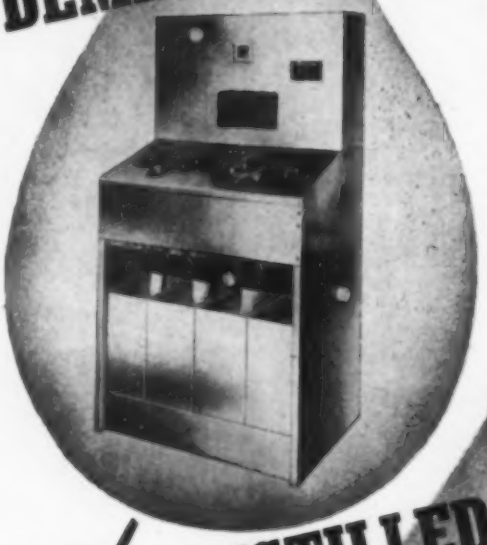
TWX is today a vital link in the nation's chain of communication. And year by year it benefits from the steady growth of the telephone system which carries it.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

Only Barnstead offers Both

DEMINERALIZED WATER



If you need high test, mineral-free water, Barnstead Demineralizers present several advantages. Greater economy, higher purity, simpler trouble-free operation, and rugged durable construction and design. They are "package units" and require only connections to water, waste and an ordinary electric outlet. Send for complete catalog.

and DISTILLED WATER

Barnstead Laboratory and Industrial Water Stills are the proven standard of the scientific and industrial world. They produce water of unmatched purity and unvarying consistency. Let Barnstead engineers give their impartial recommendation whether you need distilled water or de-ionized water. Only Barnstead offers you the best equipment for both.

Send for a Barnstead Pure Water Questionnaire, which lists the information needed by our engineers to determine what equipment you should have. There is no obligation for this service.

LEADERS IN PURE WATER EQUIPMENT SINCE 1878

Barnstead STILL & STERILIZER CO.

4 Lanesville Terrace, Forest Hills, Boston 31, Mass.

these figures reflect the policy of greater diversification and expansion upon which the corporation embarked some years ago.

Additions to fixed assets during the year aggregated $9,349,619. The amino plant at San Jose, Calif., was completed. The Noralyn phosphate mine at Bartow, Fla., was finished. The construction of new plant food mixing plants at Somerset, Ky., Winston-Salem, N. C., and sulphuric acid plants at Lockland, Ohio, and Spartanburg, S. C., were completed during the year. To provide for the increased demand for Multiphos, a phosphorus mineral additive used in animal and poultry feeds, additional plant capacity is being constructed at Wales, Tenn.

Tonnage and profits of the potash division exceeded that of the previous year, at the Carlsbad, N. M., mine and refinery operated at maximum capacity. Larger volume and greater efficiency offset higher wages and other increased costs.

With the potash contracting year commencing June 1, 1947, potash salts were sold on a basis fob. mine at Carlsbad, as the potash industry discarded the system of basing its prices as of at the major United States coastal ports, which it had been forced to do in its early days in competition with the European potash which was delivered to our coastal ports.

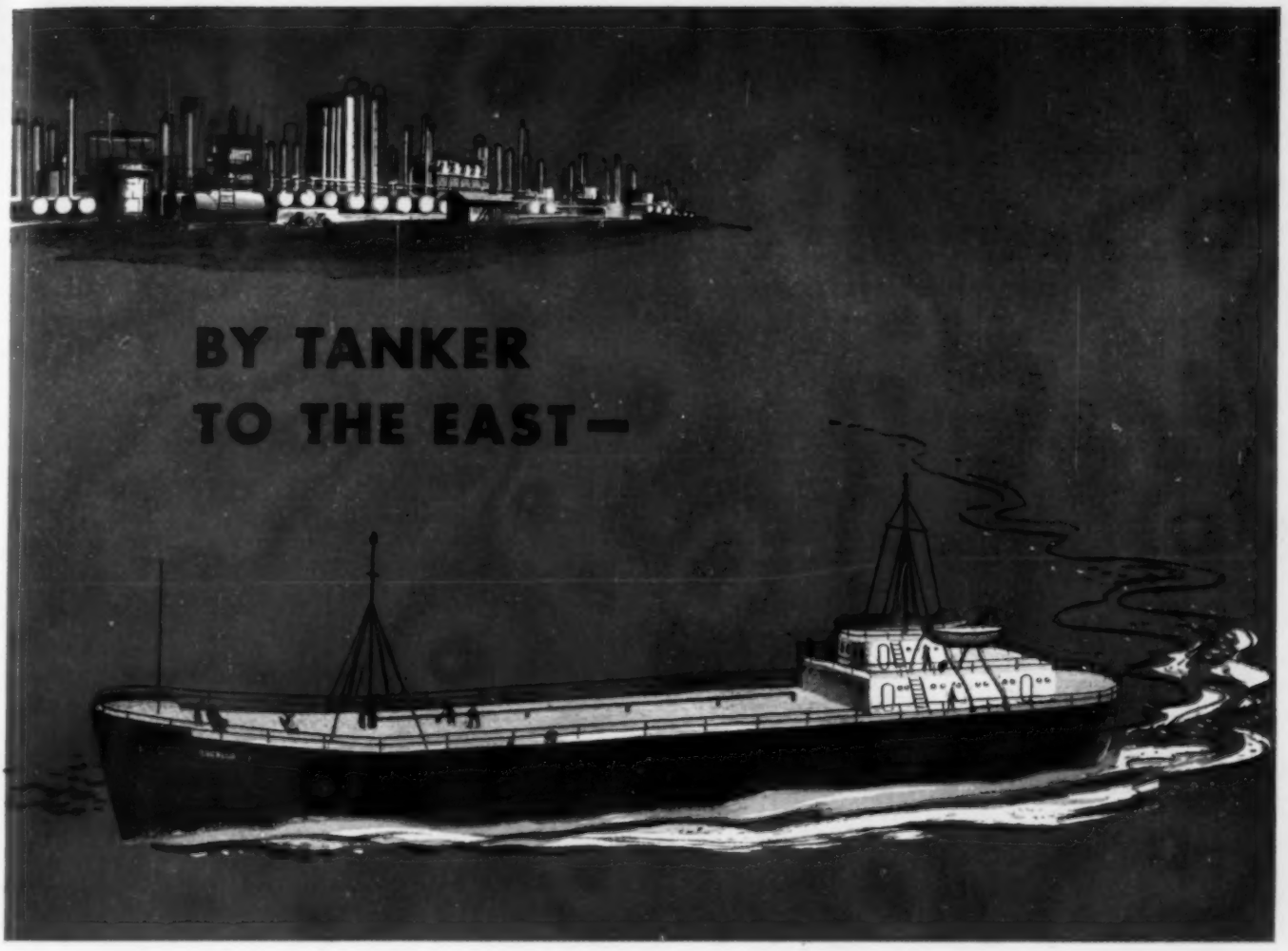
Bureau of Mines Gives Shale And Oil for Research

UNDER cooperative agreements signed recently with 10 large industrial research organizations, the Bureau of Mines has agreed to supply limited quantities of oil shale and shale oil for tests and experimentation in exchange for information on the results obtained, Director James Boyd has announced.

Materials covered in the agreements, now totaling approximately 1,250 tons of shale and 320 bbl. of oil, are being shipped from the Bureau's mines and demonstration plant on the Naval Oil Shale Reserves near Rifle, Colo.

The agreements provide that the cooperator shall furnish data on the results of tests and experiments and shall keep the Bureau informed of any important developments that arise during their progress. Either party may publish information relating to the economic evaluation of the test results, but detailed engineering and technical data shall be treated as confidential and will not be published without the written consent of the cooperator.

Companies or institutions desiring oil shale for shale oil research under such cooperative agreements should



CELANESE* FORMALDEHYDE

Supplementing nation wide deliveries of Celanese Chemicals by rail from the Chemcel plant at Bishop, Texas, Celanese is now operating the first tanker facilities for the shipment of formaldehyde. This new service provides eastern industries with additional quantities of both inhibited and uninhibited grades of this important basic commodity.

From new Celanese storage facilities at Corpus Christi, Texas, a tanker is now regularly carrying formaldehyde eastward to New Haven, Connecticut in specially insulated stainless steel compartments. From the New Haven terminal, with a storage capacity of more than 7,000,000 pounds, Celanese offers prompt deliveries of formaldehyde to Eastern consumers.

During every step of the way—from Chemcel to your plant door—the quality of Celanese* Formaldehyde is maintained at USP standards. A well equipped control laboratory at the New Haven terminal assures deliveries of the highest quality product.

CELANESE CORPORATION OF AMERICA
Chemical Division
180 Madison Avenue, New York 16

Celanese* Chemicals

*Reg. U. S. Pat. Off.

ALCOHOLS • ALDEHYDES • GLYCOLS • KETONES • ACIDS • SOLVENTS • PLASTICIZERS

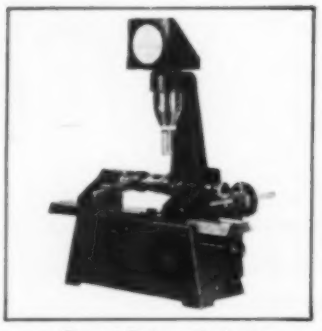
Light Projector Increases Thread Grinding Production

Production of thread grinding machines can now be increased through the use of a light projecting device called the Thread Pick-up Projector. The thread profile appears in a viewing screen, magnified 20 times, thereby permitting accurate visual adjustments.

In operation the Thread Pick-up Projector is placed alongside the thread grinding machine. A Dalzen Thread Grinder, Model No. 1, is shown above. While the machine is grinding the thread, the operator, using the Light Pick-up Projector, adjusts a "dog" on the next piece to be ground. When the "dog" and piece are then placed in the thread grinder the thread profile is automatically in location and ready for grinding immediately.

Even the most inexperienced personnel can "pick up the thread" using this instrument after only a few minutes demonstration. Grinding is also done more accurately and the viewer permits measurements of reliefs, notches, etc. to .0005 inch.

Efficiency of production can also be increased through the use of chewing gum. The act of chewing helps relieve nervous tension and seems to make the work go easier and faster. For these reasons, Wrigley's Spearmint Chewing Gum is being made available more and more by plant owners everywhere.



Thread Pick-up Projector

Complete details may be obtained from
Acme Scientific Company
1437 West Randolph, Chicago 7, Illinois

AC-76

write to Mr. Boyd Guthrie, Chief, Oil-Shale Demonstration Plant, Bureau of Mines, Rifle, Colo., giving full information as to the quantity desired, the purpose for which it is to be used, and proposed shipping arrangements to be made.

ASEE Holds Third Course for Chemical Engineers' Teachers

More than 200 members of the American Society for Engineering Education and their families attended the Third Summer School for Teachers of Chemical Engineering, held this year on the campus of the University of Wisconsin.

The school was held August 30 to September 4 and was sponsored by the Chemical Engineering Division of the American Society for Engineering education and the University of Wisconsin. R. A. Ragatz of the University of Wisconsin department of chemical engineering was chairman of the program committee.

The two previous summer schools for teachers of chemical engineering were held at the University of Michigan, in 1931, and at Pennsylvania State College in 1939.

In addition to technical sessions on thermodynamics, unit processes, applied electrochemistry, kinetics, instrumentation, plastics, and teacher qualifications, the program included a picnic and a banquet.

Norton Opens New Abrasives Plant in Worcester

Norton Co. recently dedicated a new abrasives plant in a private ceremony at Worcester, Mass. Over 602 ft. long and 320 ft. wide, containing approximately 5 acres of manufacturing space on one floor, the building is the largest in the world for the manufacture of grinding wheels.

The building was especially designed and constructed to house a radically improved process of grinding wheel manufacture—a process which enables wheels to be made to new standards of precision in dimensions and balance with a degree of uniformity previously considered impossible in a vitrified product.

Cost of the plant was estimated by company officials at $4,300,000, of which $1,800,000 was for the building alone and $2,500,000 for equipment.

The huge building lends itself ideally to straight line production and parallel manufacturing lines have been set up throughout the length of the plant. Abrasive grain and bond are brought into one end of the building

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AIR AS YOU WANT IT!

For air or gas delivered as you want it, in controlled volumes through 100,000 cfm, against constant or varying pressures —call upon De Laval.

De Laval blowers, compressors and exhausters are made in a wide range of sizes, both single and multi-stage for either constant or variable speed drive, the latter of which can be furnished by steam turbine, variable speed coupling, or DC motor.

For information concerning the compression and flow of air and gases, write for Catalog F.

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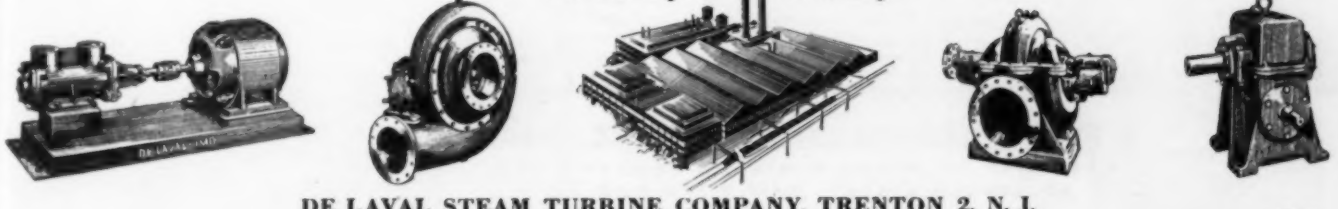
De Laval for Industry



DE LAVAL STEAM TURBINE COMPANY, TRENTON 2, N. J.

C-10

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

6 times THE POWER OF ORDINARY SOLENOID VALVES

GENERAL CONTROLS
K-10 SERIES
ELECTRO-MAGNETIC
LEVER VALVES

CONTROLS: LIGHT AND HEAVY OILS, AIR, WATER, GAS, STEAM, REFRIGERANTS, etc. Suitable for pressures up to 1000 pounds and temperatures up to 400° F.

SIX TIMES THE POWER of ordinary solenoids assures high seating pressure and overcomes the blocking effect of viscous fluids, such as heavy fuel oil. Adequate power of solenoid insures positive operation. Normally closed or open types available.

Internal valve assembly can be removed for cleaning and inspection if necessary. Two-wire—A.C. or D.C.—current failure—packless construction—bronze body—stainless steel and bronze internal parts—soft seats available.

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Manufacturers of Automatic Pressure, Temperature, Level & Flow Controls

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FILTRATION · WASHING · DRYING

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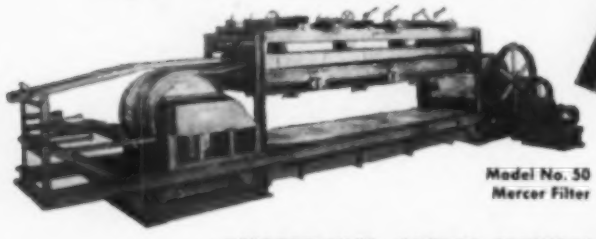
Low-cost Efficient Continuous Suction Process



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Mercer Filter

PERFORMANCE—PROVEN FEATURES

Multiple washing zones. Evenly formed filtered cake. Varied thicknesses. Automatic cake discharge. Continuous filter medium cleansing. Low power consumption.

Arrange for Test

Mercer plant is equipped to conduct and report upon experimental tests made with samples of your materials. Inquire about this service.

"The Name that Carries Weight"

MERCER ENGINEERING WORKS, INC.
REPRESENTED BY MERCER-ROBINSON COMPANY, INC.
30 CHURCH STREET, NEW YORK 7, N. Y.

Sales Offices in Principal Cities

and the various production steps take place in quick succession. A radically new feature of each production line is the continuous electric firing of grinding wheels in specially designed kilns. Modern conveying equipment has been extensively used to hold handling to a minimum.

Big Rubber Purchase For Stockpile

UNCLE SAM is beginning to realize in a modest way some returns from the ECA program through opportunity to buy strategic materials for the preparedness stockpile. Evan Just, Editor of *Engineering and Mining Journal*, on loan to ECA, has been able to negotiate a number of purchases from the British, Dutch and French. He reports arrangements "more successful than originally hoped for."

Outstanding achievement is the agreement of the British to supply 25,000 tons of natural rubber for the stockpile at a price between 22 and 25c. per lb. Negotiations are well along for comparable sales to this country of sisal, coconut and palm oils, asbestos, graphite, mica, and bauxite. These procurement efforts will not interfere with the simultaneous activity of the Treasury Department for purchases from commercial interests, recently announced as a program by Munitions Board.

AEC Chicago Office Takes Over Battelle Contract

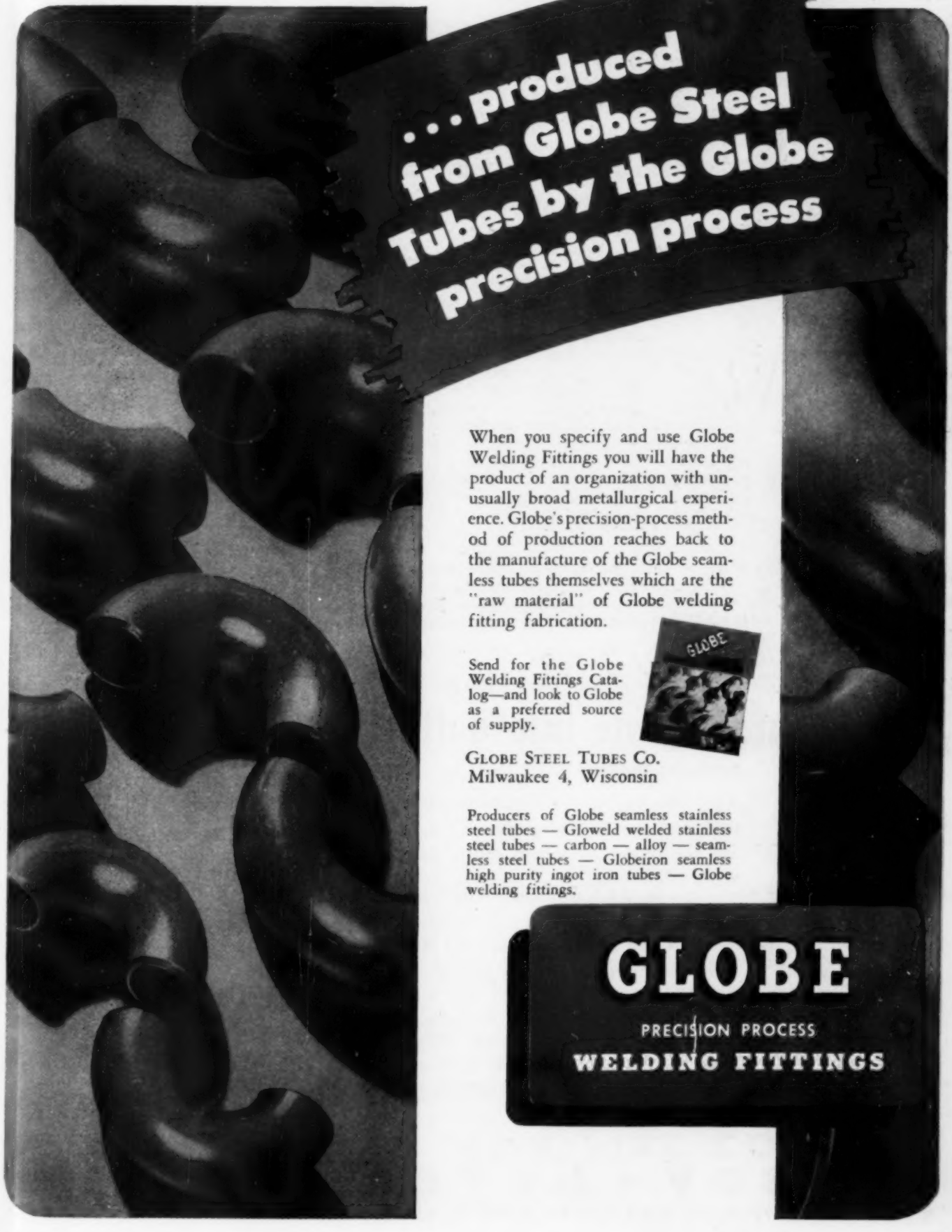
THE Atomic Energy Commission has announced that administration of the research service contract between Battelle Memorial Institute, Columbus, Ohio, and the commission was assumed by the Office of Chicago Directed Operations as of September 1. The contract which involves research and services in the field of metallurgy had previously been administered by the Oak Ridge Directed Operations office of AEC.

Committee Reports on Fatal Lab Blast

A JOINT committee of technical specialists from industry and the Bureau of Mines has reported with recommendations on their investigation of the explosion which killed two men and injured a third at the Bureau's Bruceton laboratory on August 13.

A hydrogen cylinder exploded from a source of ignition not fully known because it accidentally contained a mixture of air and hydrogen, instead

GLOBE WELDING FITTINGS



. . . produced from Globe Steel Tubes by the Globe precision process

When you specify and use Globe Welding Fittings you will have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.

Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply.

GLOBE STEEL TUBES CO.
Milwaukee 4, Wisconsin

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe welding fittings.

GLOBE
PRECISION PROCESS
WELDING FITTINGS

Cranberry Growers process waste Harvest another kind of "berries"

Another triumph of Hersey dryers and engineering

You won't find pulp and waste in the canned cranberries you buy, yet they make up a large part of the crop.

Where does the waste go? —

Once it was disposed of — dumped or burned. Then chemists at a Massachusetts packing plant discovered that, properly dried, cranberry skins are an excellent source of ursolic acid (an emulsifier used in cosmetic manufacturing), the seeds rich with expensive cranberry seed oil. They brought their problem to Hersey. "Build us a dryer which will economically recover these valuable products," they said. So Hersey engineers designed and built two-stage drying equipment which filled the bill. Installed at the packing plant, this equipment now converts waste into by-products *more valuable than the original cranberry crop.*

Are you dumping dollars because you lack the right recovery equipment? Let Hersey study your problem — their recommendations cost nothing, may point the way to new profit opportunities.

Write for information today.

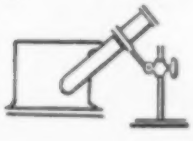
Hersey turns waste into dollars!

PICKLING WASTE

Metal product manufacturers using Hersey equipment are recovering zinc sulfate, anhydrous and the crystals of ferrous sulfate from pickling waste formerly dumped.

SWEET POTATO PULP

A feed manufacturer is using Hersey equipment to convert sweet potato pulp into cattle feed.



BEET SUGAR WASTE

From the Steffens Water derived in beet sugar production, a San Jose, California plant is recovering glutamic acid with Hersey drying equipment.

hersey • dryers

Division Hersey Mfg. Co. • E & Second Streets • So. Boston, Mass.

of pure hydrogen. Suspected of causing the ignition was the heat generated in a pressure regulator which is suspected of having been contaminated with oil or another material accelerating temperature rise.

The committee offers seven specific recommendations to prevent recurrence, most of which are applicable only to the particular equipment in use at the Bureau. Precautions of general applicability include prompt analysis of a sample from each lot of cylinders charged and the establishment of "more definite procedures and responsibilities for maintenance, repairs, construction, and operations."

The complete report, which is available from the Washington office of the Bureau of Mines, also discusses potential causes of explosion and some general precautions which can well be observed in any laboratory handling flammable gases or oxygen under pressure.

Diamond Boosts Silicate Output at Dallas

Diamond Alkali Co. has put into operation at Dallas, Tex., a new furnace which will increase by about 50 percent the output of sodium silicate at the Dallas plant. This is the third furnace installed by Diamond at Dallas since 1941.

Plant Finder an Aid To Chemical Engineers

Copies of "Plant Finder" should be sought by chemical engineers from War Assets Administration, Washington 25, D. C., if they are looking over existing surplus property. In view of extremely high construction costs, some process industry executives are combing the limited list of remaining property hoping to find something adaptable to their needs at lower capital cost than new construction. Some of these folks are sure to be lucky. It costs only a postage stamp to get a copy of "Plant Finder" to see what it might suggest.

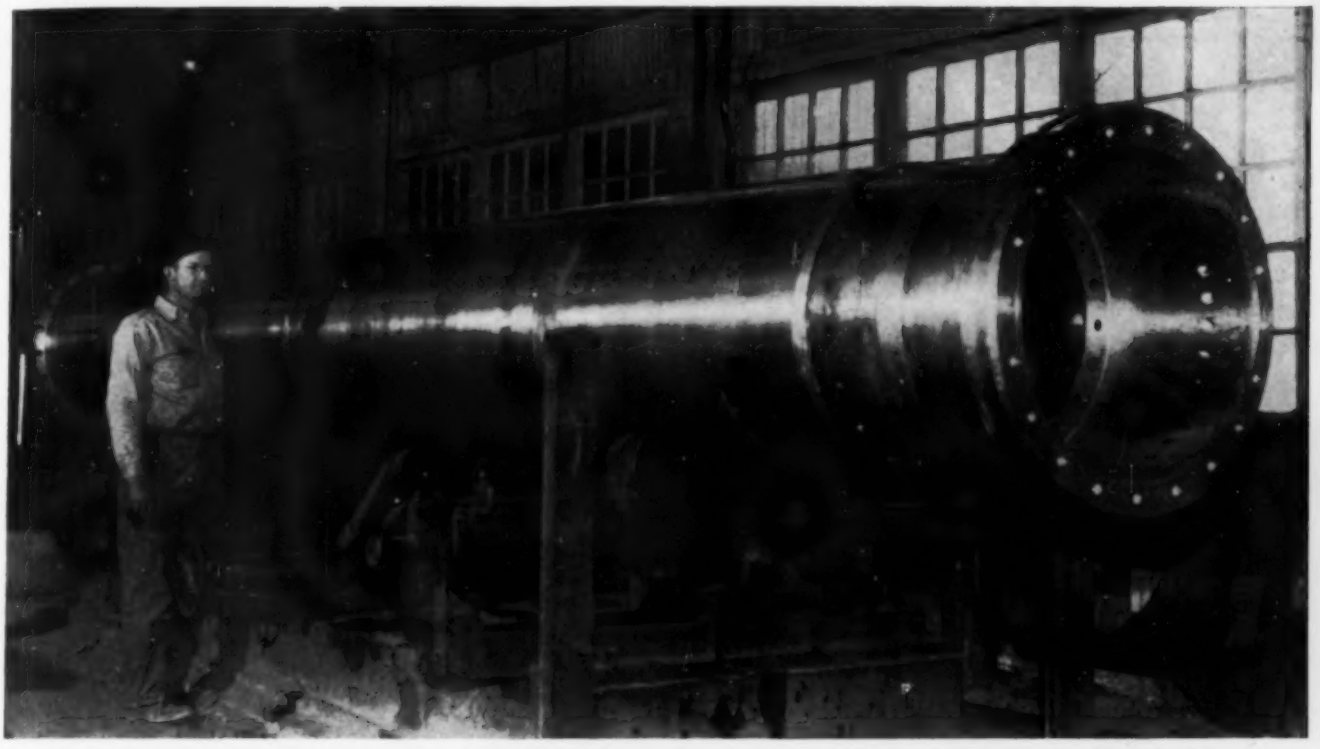
Rules For New Drugs Aid Development

Offering a new drug for experimental purposes from chemical or pharmaceutical enterprise is closely regulated by the Federal Food, Drug, and Cosmetic Act. Some criticism of the administration of that Act has been heard occasionally, charging that it was almost impossible to secure proper investigations without techni-

Centrifugally Cast

ACIPCO STAINLESS STEEL

Tubes & Parts



One of several 25%-20% Chrome-Nickel Stainless Steel Retorts furnished to a large chemical manufacturer. Fabricated by electric welding of centrifugally cast tube sections machined 34" O.D. by 32" I.D. by 12'-0" long, and end flange sections cast in stationary sand molds, to make a completed unit 27'-6" long. Completely machined all over. Hydrostatically tested at 300 p.s.i. and air tested at 100 p.s.i. Weight per unit 13,600 lbs.

Extensive facilities permit quantity production of centrifugally cast stainless and carbon steel tubes in diameters from 3.50" to 50" O.D. Wall thickness can be varied to suit specific applications. In addition, alloy cast irons, including the Ni-Resist grades, can be furnished in tubes of the same range of diameters and in pipe fittings. Static sand castings can be furnished from one pound to several thousand pounds.

A new development is ACIPCO Ni-Resist bolts combining high strength with ductility and having high resistance to corrosion. Bolts can be either square or teehead and are furnished in sizes ⅝" x 3" through 1½" x 7½".

Acipco is fully equipped with modern electric furnaces, complete laboratory and testing facilities, pattern and machine shops to produce and fabricate your casting requirements. Inquiries are invited.

Steel Castings Division

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM 2, ALABAMA

GET ALL THE

Metallurgical Facts...

AND YOU WILL KNOW WHY LADISH

Controlled Quality

FORGED STEEL FITTINGS STAY IN SERVICE LONGER

Fact Rigid laboratory control of forging processes increases strength and toughness.

Fact Controlled grain flow provides maximum resistance to shock, strain and stress.

Fact Dense, homogeneous metal structure retards action of erosion and corrosion.

Ample Stocks... Prompt Service... Carbon, Stainless and Alloy Steels ⅛ through 4 inches, 2000 through 6000 pounds.

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cal violation of rules. F&DA has taken account of this and offers new regulations.

The proposed rules which unquestionably will be adopted, with or without amendment, provide both for experimental distribution of new American products and of new imported products. Special labeling is required to show "Caution: New Drug—Limited by Federal law to investigational use." Distribution may be made only to experts qualified to use them safely and those who will certify their cooperation. Considerable convenience is anticipated for distributors, all within limits to insure public protection.

Heyden Chemical Buys Rumford Chemical Works

HEYDEN CHEMICAL CORP. has acquired the assets of Rumford Chemical Works, Providence, R. I.

B. R. Armour, president of Heyden, and A. E. Marshall, president of Rumford, have announced that Heyden and Rumford have entered into an agreement in which Heyden would, subject to certain conditions, get all the assets of Rumford in consideration of the assumption of all of Rumford's liabilities and the issuance to Rumford of 99,438 shares of Heyden's common stock.

The agreement has been approved by the Board of Directors of both companies, but is subject to the approval of Rumford stockholders.

Compton and Griswold Elected To Board of Tracerlab

KARL T. COMPTON, president of Massachusetts Institute of Technology and Merrill Griswold, chairman of Massachusetts Investors Trust become directors of Tracerlab, Inc., effective August first according to an announcement by William E. Barbour, Jr., president of the company.

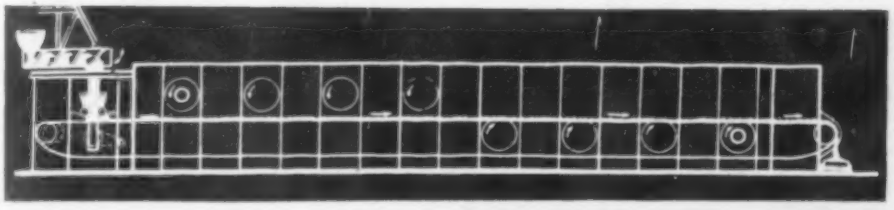
Concurrent with the addition of two new directors, Barbour announced completion of the private sale of $300,000 of a Series B Convertible Preferred Stock. These funds are to be used for the expansion of the company's instrument design and production facilities and in the radiochemical program, especially "tagged" organic compounds of Carbon-14 and non-radioactive isotopic tracer substances.

Workers Protected In Every State

WORKMEN'S compensation laws are now on the statute books in every state. Mississippi was the last to pro-

CHEMICAL Drying DATA
BULLETIN NUMBER 7
PUBLISHED MONTHLY FOR PROCESS INDUSTRIES EXECUTIVES AND OPERATING PERSONNEL

DRYING SYSTEMS FOR PIGMENTS OFTEN MUST COMBINE HIGH CAPACITY WITH CLOSE CONTROL OF QUALITY



Combining one of the Proctor preforming feeding devices with a continuous conveyor dryer and applying the principle of "aeroform" drying has been the answer to the needs of the pigment industry—which frequently must obtain large scale production without sacrifice in quality. Through the intelligent application of this advanced method of drying, it is now possible to dry the same amount of pigment in one hour that formerly required twenty-four hours. Not only has drying been speeded—but the quality assured, because of the close control that is possible with this system. One of the chief problems to overcome was that of increasing the hourly output by speedy drying and at the same time preventing surface-baking or case hardening. By preforming the pigment into small, uniform shapes—and then circulating heated air through the bed of pigment on a moving conveyor—rapid diffusion takes place with the result that drying time is reduced and surface-baking or case hardening is prevented. The pigment is ideally suited to subsequent processing.

Above: Drawing shows system used for drying titanium dioxide. Photo illustrates extruded particles as carried through the dryer.

Careful study of the physical characteristics of any particular plastic have enabled Proctor engineers to recommend the type of preforming best suited. For example—titanium dioxide is preformed by means of a rolling extruder, while white lead is preformed by means of a fin drum feed. The physical characteristics in each case dictating the method used.

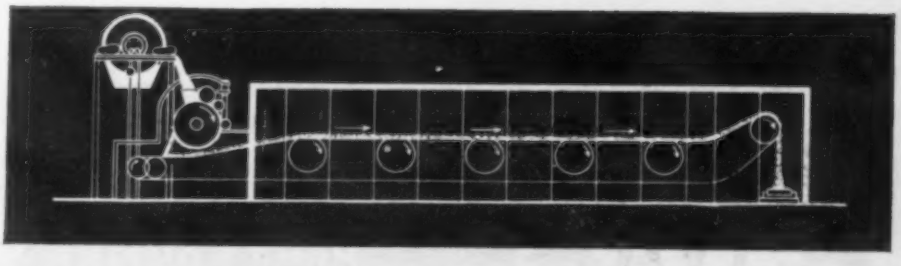
Since drying is a vital link in the processing of pigments—output is controlled to meet the individual plant's rate of production.

BOOKLETS EXPLAIN OTHER APPLICATIONS FOR PROCTOR CONTINUOUS SYSTEMS

Case histories of 11 installations of Proctor continuous conveyor dryers combined with preforming feeds. Complete details on how systems apply to 11 different products.

Lucid explanation of the principle of "preforming" and continuous conveyor drying, as particularly applied to the chemical process industries.

Below: Drawing shows fin drum feed and continuous conveyor dryer used for drying white lead. Photo shows white lead formed into fin drum sticks.



PROCTOR & SCHWARTZ, INC. • 711 TABOR ROAD • PHILADELPHIA 20, PA.

Sharp Separation **Uniform Fineness**

FOR BATCH OPERATION—the Schutz-O'Neill Pulverizer with Receiver Box is a versatile unit. Easy to clean or change for different materials. *Accurate grinding control.*

Air force pulverizing plus air separation is the proven, automatic, dustless method for rapid processing of any dry, grindable, non-gritty stock to desired fineness. Available in sizes from 12" up to 28", with capacities ranging up to 2,000 lbs. per hour. *Ask our engineering department to analyze your requirements. No obligation.*

Also makers of Schutz-O'Neill Gyrator Sifters, Roller Mills, Hammer Mills, Etc.

ESTABLISHED 1893 **SCHUTZ-O'NEILL CO.**

PULVERIZERS • BREAKER MILLS • ROLLER MILLS • BURR MILLS • HAMMER MILLS

301 SIXTH AVENUE SOUTH • MINNEAPOLIS 15, MINNESOTA

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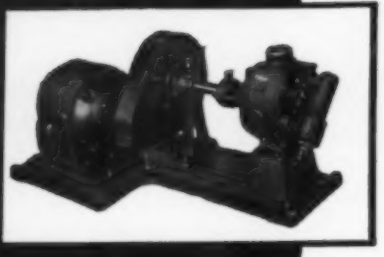
The Rotary Pump, Built To Create and Retain your CONFIDENCE



The building of a piece of equipment to win your confidence is the aim and purpose of every Viking that leaves the factory.

Confidence can only be *won* and *retained* with a pump that will actually go out and do the job it is sold to do.

Look to Viking for the pump that builds confidence. A self-priming, simply and ruggedly constructed pump suitable for delivery against discharge pressures.

Write today for free bulletin 47SC. It will be sent immediately.

See Our Catalog In SWEETS

Viking PUMP COMPANY Cedar Falls, Iowa

vide such protection for injured workers by a law recently adopted, to become effective next January. Most of the laws are mandatory; but a few are elective. Under these, the employer may choose not to participate; but if he so chooses, he surrenders certain defenses against damage claims.

Maximum compensation for injury and maximum compensation to dependents in the case of fatal accidents vary widely among the states. Those interested in making comparisons can be supplied with rather complete information by the Bureau of Labor Standards, Washington 25, D. C.

Natural Gas Rates by General Tariffs

COMPREHENSIVE price schedules for natural gas from long distance pipelines may be fixed by Federal Power Commission action started in September. Heretofore pipeline companies have sold gas by individual contracts with large purchases. That system of negotiation will be discontinued if the proposed new rules of FPC are adopted. Interested parties can follow the proceedings of the hearings which began September 20.

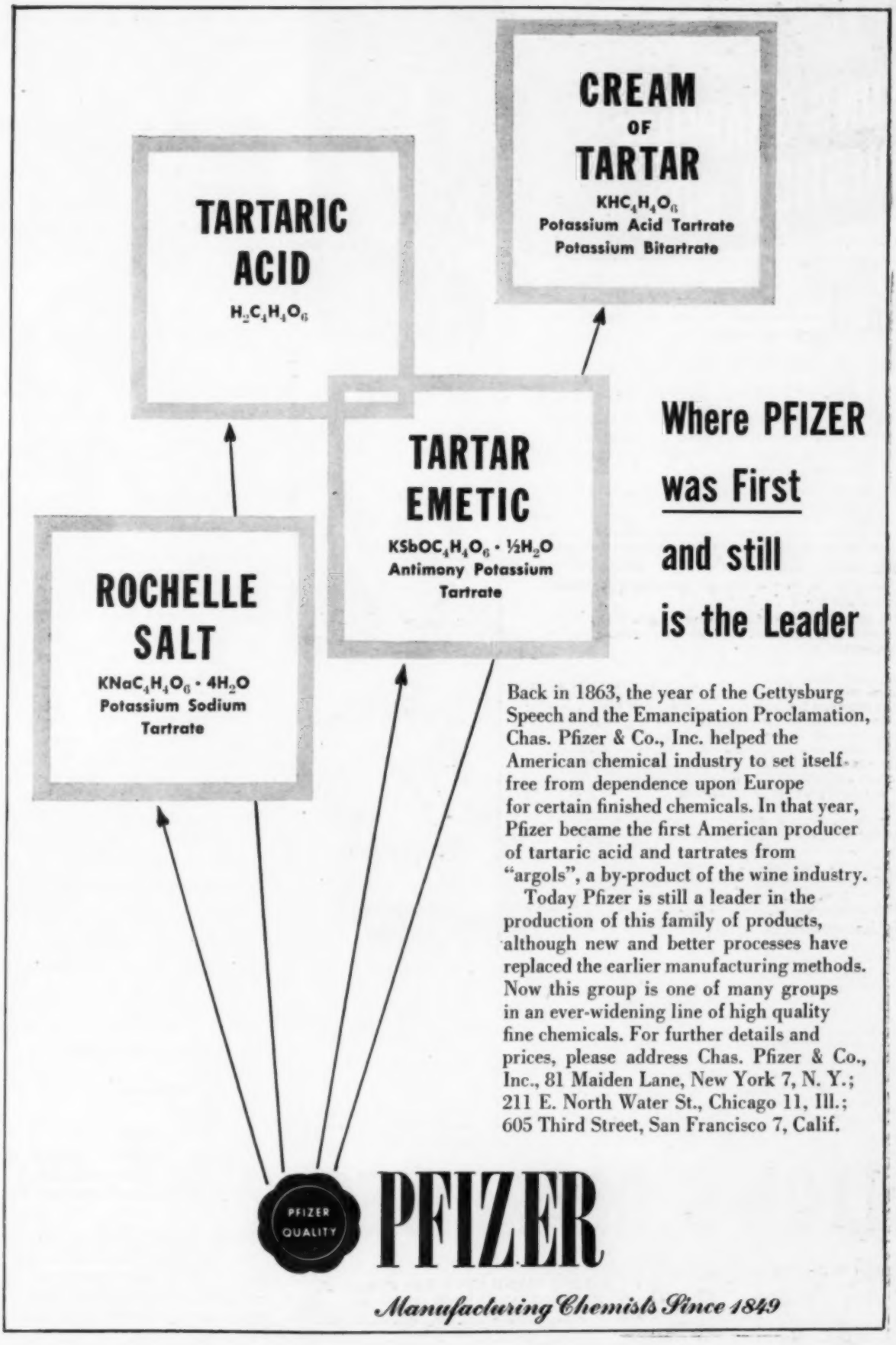
Frontier Chemical Expands At Denver City

FRONTIER CHEMICAL CO., which markets most of its output among oil producers, is doubling its capacity to manufacture caustic soda and hydrochloric acid at Denver City, Tex. The company is installing 32 additional Hooker "S" cells and solidifying and flaking equipment. After the expansion is completed around Nov. 1 the present monthly capacity of 360 tons of caustic and 1,300 tons of acid will be increased to 750 tons and 2,600 tons respectively. The project amounts to about $400,000.

News Briefs

Glidden Co.'s sales for the nine months ending July 31, 1948, increased $15,617,788 over the total for the same period of 1947. Net profit for the nine-month period amounted to $5,630,161, equal to $3.02 per share of outstanding common stock, after provision for dividends on convertible preferred stock and elimination of treasury shares. This compares with earnings of $6,088,761, or $3.25 per share for the same period last year.

Celanese Corp. of America has reported net income of $11,024,933 after all charges and taxes for the three



Where PFIZER was First and still is the Leader

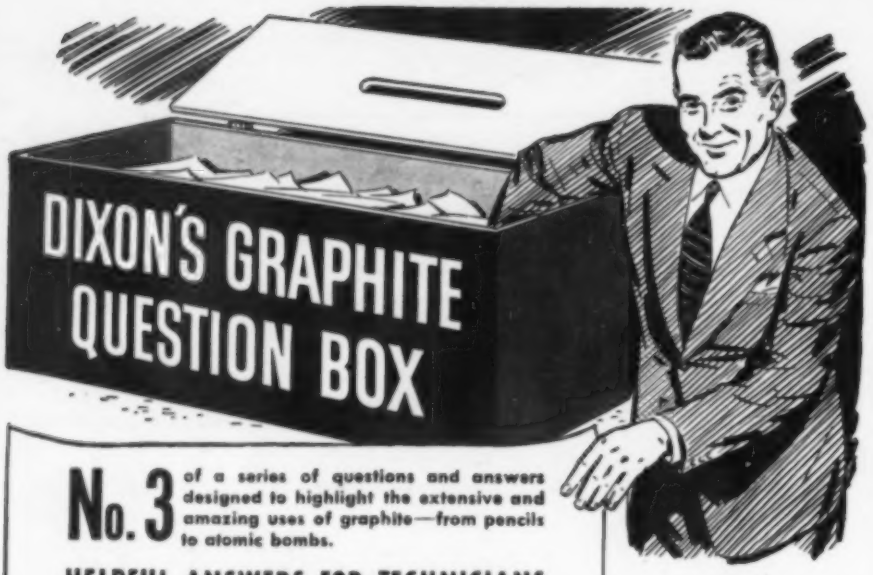
Back in 1863, the year of the Gettysburg Speech and the Emancipation Proclamation, Chas. Pfizer & Co., Inc. helped the American chemical industry to set itself free from dependence upon Europe for certain finished chemicals. In that year, Pfizer became the first American producer of tartaric acid and tartrates from "argols", a by-product of the wine industry.

Today Pfizer is still a leader in the production of this family of products, although new and better processes have replaced the earlier manufacturing methods. Now this group is one of many groups in an ever-widening line of high quality fine chemicals. For further details and prices, please address Chas. Pfizer & Co., Inc., 81 Maiden Lane, New York 7, N. Y.; 211 E. North Water St., Chicago 11, Ill.; 605 Third Street, San Francisco 7, Calif.

PFIZER QUALITY

PFIZER

Manufacturing Chemists Since 1849



No. 3 of a series of questions and answers designed to highlight the extensive and amazing uses of graphite—from pencils to atomic bombs.

HELPFUL ANSWERS FOR TECHNICIANS AND PRODUCT ENGINEERS

QUES. Is graphite processed into all required forms and shapes that make it usable for innumerable manual, mechanical, chemical and electrical applications?

ANS. Graphite owes its remarkable versatility to its almost unlimited scope of form and formulation. It is available in a wide variety of microscopic powders, large flakes, fluids, non-fluids, concentrates, bars, tubes, sheets, plates and specially processed shapes.

QUES. What are *some* of the products or processes in or on which graphite is used? (*Continued from No. 2*)

ANS. Suspensions and concentrates
Pressure pad lubricant for belt type sanding machines
Penetrating and rust dissolving lubricants
Stop cock lubricants
House movers' lubricant
Lace machine lubricant
Boiler water-scale conditioner
Miscellaneous grease, oil and aqueous lubricants
Miscellaneous grease and oil compounders' graphites
Miscellaneous lubricants of special structures, densities and shapes
Gunpowder glazing and pelleting
Glass makers' lubricants
Ferry rack lubricants
Synthetic rubber tire tube lubricant
Auto under-chassis spraying lubricant
Auto spring and shackle lubricant
Miscellaneous marine engine and equipment lubricants
Miscellaneous aircraft lubricants

On Railroads:
Brake cylinder lubricant
Triple valve lubricant
Curved track lubricant
Centerplate lubricant
Diaphragm, chafing plate and pedestal plate lubricant
Pantograph shoes
Hub liner lubricant
Driving spring lubricant
Cup and driving journal lubricant
Semaphore lubricant
Car seat and window slide lubricant
Engine front and jacket finishes

(*To be continued in No. 4*)

A few of thousands of widely used products containing Dixon's Graphites. Those starred are Dixon's products, many of them sold by supply houses everywhere.

★ Slipstik, Gruastik, G-711 Stick

Brake Linings

★ Cup Grease No. 3

Now may we receive *your questions* on how graphite can help *you?*

DIXON'S GRAPHITES

Products of
JOSEPH DIXON CRUCIBLE COMPANY
Jersey City 3, N. J. Dlv. 243-Q-10

LOOK FOR No. 4
in this series. We will gladly send you reprints of any you may miss

months ended June 30. This was equivalent after preferred dividends to $1.86 per share of outstanding common stock. This contrasted with net of $1.62 a share, in the three months ended March 31, 1948, and 74 cents a share, in the three months ended June 30, 1947.

Chas. Pfizer & Co., Inc., reports for the six months ended June 30, 1948, net income of $5,556,709, equal after preferred dividends to $3.69 per share on the 1,480,050 shares of common stock outstanding. This compares with net income for the six months ended June 30, 1947, of $4,027,079 or $2.72 per share.

General Aniline & Film Corp. has announced that profit for the first half of 1948 amounted to $3,651,000 compared with $1,677,000 for the same period in 1947.

Davison Chemical Corp. declared a quarterly dividend of thirty-seven and a half cents ($0.37½) per share on its capital stock, payable September 30.

Monsanto Chemical Co.'s sales during the six months ending June 30, 1948, amounted to $78,739,148, an increase of 11 percent over the corresponding period of 1947. Net earnings for the first six months of 1948 were $7,926,759, equivalent to $1.73 a common share.

Lion Oil Co. has declared a regular quarterly dividend of $0.75 per share on the common stock.

Weirton Steel Co.'s new $4 million oxygen plant will be finished in about three months in Weirton, W. Va. The plant, largest of its type in the world, will produce approximately 400 tons of oxygen daily.

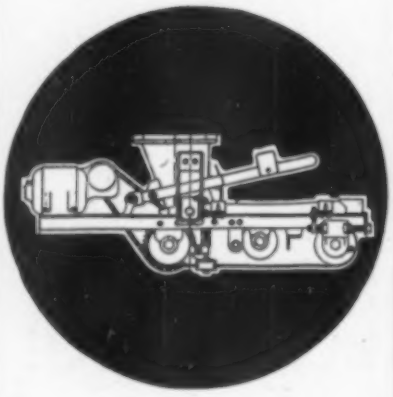
Firestone Tire & Rubber Co., Akron, Ohio, will concentrate all its plastic activities at its plant in Pottstown, Pa. Roger S. Firestone, president of Firestone Plastics Company, and his staff will move from Akron to Pottstown; management and sales also will be transferred.

National Fertilizer Assn.'s new president is Dr. Russell Coleman, he succeeds M. H. Lockwood on Nov. 1.

South Texas Cotton Oil Co. is installing a $200,000 hydrogen generating unit in the company's cotton oil products plant at Houston. The Girdler Corp. is the designer and builder of the unit, which will produce hydrogen by the catalytic reaction of natural gas with steam.

Satincast
THE "NEW LOOK" IN
COOPER
STAINLESS STEEL
FITTINGS
Satincast, smooth as satin itself . . . is a newly developed finish by COOPER ALLOY which is Standard on all COOPER Stainless Steel Fittings. Satincast finish is also available on Special Castings of moderate size.
T.M. REG. PENDING
LUSTRACAST by COOPER
This famous COOPER ALLOY electrolytic polish for fittings and castings brings out the natural brilliant luster of Stainless Steel as well as greatly increasing its resistance to contamination and corrosion. Lustracast finish is available at a slight extra cost.
Specialists in Corrosion Resisting Stainless Steel
THE COOPER ALLOY FOUNDRY CO.
HILLSIDE, NEW JERSEY

ELIMINATE *feed-rate variation*



. . . *with*
HARDINGE CONSTANT-WEIGHT FEEDERS

The revolutionary Hardinge Constant-Weight Feeder regulates the feeding of materials at a constant-weight rate, rather than a constant-volume rate. The feeder automatically compensates for changes in *specific gravity* and *bulking*, due to moisture—which normally would cause irregular feeding.

HARDINGE BUILDS DISC FEEDERS, TOO

Ideal for handling hot, sticky or bulky materials—the Hardinge Disc Feeder is simple, requires little head room, and has two capacity adjustments, one of which can be changed during operation. No bridging—no clogging.

Write for Bulletin 33-D which describes the complete line of Hardinge feeders in detail.

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READERS' VIEWS AND COMMENTS

The Roster

To the Editor:

Sir:—Before me is my certificate of registration in the National Roster of Scientific and Specialized Personnel, War Manpower Commission, Washington, D. C., Form 107 NR, No. A-453-322, dated 12 p.m., 22 March 1945. The "Roster" was transferred to the National Clearing House, U. S. Employment Service, Dept. of Labor somewhat later. An inquiry of mine to this Service was answered on 25 June 1947 to the effect that "there is no record of your application in the National Clearing House files."

The Chementator states that military authority wants "a peacetime roster of all scientific workers." If they get it, is there to be any guarantee against incidents such as above? When registrations can be so blithely lost or mislaid in two years, there is no certainty that "scientists and engineers should be fully utilized in essential work for the national defense effort."

It would be interesting to survey the personnel files of various war plants and arsenals. How many chemists and chemical engineers were employed in these upon non-chemical work, during and after the war emergency? What efforts were made to screen and transfer such personnel to positions where they would be better utilized?

R. E. BOWMAN

Blacksburg, Va.

Isopleth, Isosyst

To the Editor:

Sir:—I have read V. C. Williams' Letter to the Editor (*Chem. Eng.*, Aug. 1948, p. 198) in which he proposes that the word "isosyst" be used to fill the need for a word denoting constant composition. I believe there is already a word with this meaning. In the chapter on Heterogeneous Equilibrium in Taylor's "Treatise on Physical Chemistry," lines of constant composition are termed "isoplethic" lines, or simply "isopleths."

NATHAN KAPLAN

Research Chemist
Kollsman Instrument Division
Square D Co.
Elmhurst, N. Y.

Wesbster says "isopleths" are "equal in quantity or number." "Isosyst" means "equal or the same in composition."—Editor.

Illustrated are two strainer baskets. They were fabricated by Multi Metal according to blueprints, constructed of all stainless steel with special wire cloth specifications. This is one of hundreds of specially fabricated units by Multi Metal. Whether your requirements are for a cut piece of wire cloth or a completely fabricated unit, Multi Metal's Service department offers its technical and efficient counsel. Send us your specs for quick and economical solution. Catalogs available.

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in the chemical industry

for 25 years

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Because of unequaled reliability . . .

LaBour pumps have rated first with cost-minded chemical plant men for a full quarter of a century. In any year, at any job, a LaBour is your assurance that costly down-time will be held to the very minimum. . . . That's the real measure of economy in pumping liquid chemicals.

The Type Q, one of the later LaBour developments. LaBour builds both self-priming and non-priming units to meet all liquid moving requirements of the chemical industry.

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THE LABOUR COMPANY, Inc. • ELKHART, INDIANA, U.S.A.

COMPLETE ACCESSIBILITY PERMITS EITHER METALLIC OR CLOTH DRESSING

With the new Conkey Rotary Leaf Pressure Filter, leaf dressings may be either metallic or fabric.

Any leaf sector may be removed through the air cylinder actuated inspection doors for cloth redressing without disturbing any other sector. This accessibility, without the necessity for opening up filter and tearing down the entire element to replace a single sector cloth, makes possible the operation of this filter with textile cloth dressings.

Special sector drain hubs and sector clamps permit dressing the unit with flat filter cloth — eliminating stitched seams on filter surfaces and the passing of cloudy filtrate.

This is but one of the many advantages available for improving filtration of products not applicable to continuous filtration. Write for Bulletin No. 105 which gives further details on application and construction.

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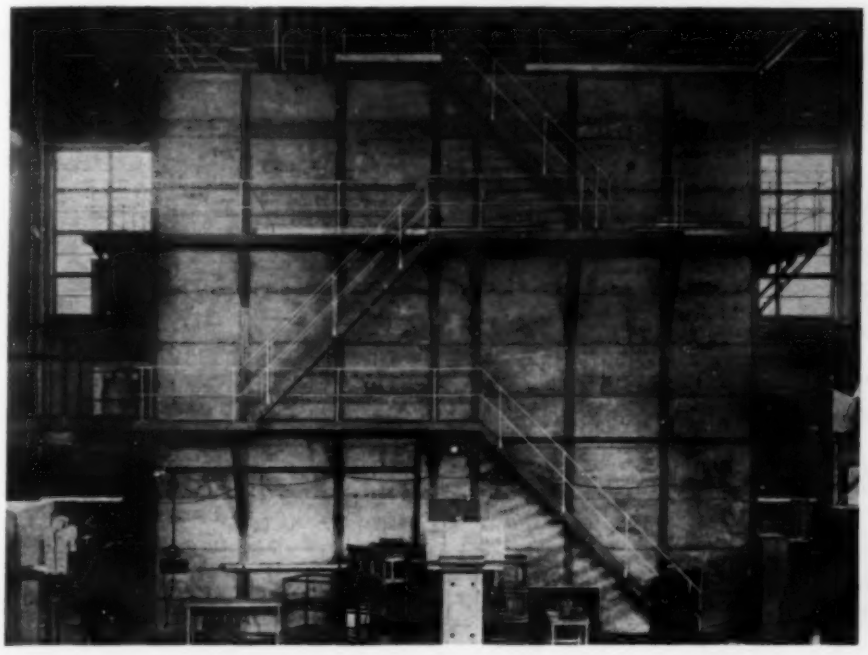
NEWS FROM ABROAD

Special Correspondence

McGRAW-HILL *World News*



GLEEP at Harwell is one of two nuclear piles operating in Britain.

In Spite of Increasing Research English Say Atomic Power Is Ten Years Away

COMMERCIAL power from nuclear energy is still ten years away. That is the opinion of all well-informed scientists now working in this field, according to Sir John Cockcroft, director of Britain's Atomic Energy Research Establishment.

Reason: four major technical problems still have to be solved. (1) The fuel problem: investigations so far have shown that while natural uranium piles which could generate power as a byproduct are technically feasible, their fuel efficiency would be so low that they would not be economical. Natural uranium piles "burn up" only a very small proportion of the uranium. The fuel problem thus becomes the so-called "breeding" problem: finding a way to utilize the greater part of the uranium "fuel" consumed in the pile. Primary fuel source, uranium 235, must be made to breed secondary fuel from U-238 or thorium. Until this is done, present resources of uranium will be insufficient for large-scale nuclear power. (2) The metallurgical problem: finding materials better suited to withstand high temperatures which can be used in construction of piles. (3) The combustion problem: finding an efficient way to process the nuclear fuel used in the pile, which includes removing the intensely-radioactive ash from the fuel safely and economically. (4) The ash disposal problem: getting rid of the large quantities of this radioactive ash that would be produced by the sizable number of nuclear power stations that would be required to supply the world with sufficient power.

These problems are difficult, and their solution will take time, Sir John thinks. One of the jobs of the AERE is tackling these problems, and it is probable that a number of pilot plants will have to be built for this purpose. Up to now, AERE has been busy with more fundamental problems.

Britain's two nuclear piles, GLEEP (100kw.) and BEPO (6,000kw.) are located at Harwell, site of British atomic research.

Wool Research Lab Headed by Whiffen

THE AUSTRALIAN government has established (as one of the largest units in its national research program) a new wool research laboratory. The site has been chosen and building plans are well under way. It will be an institution comparable with some of the major technical bureaus in the U. S. Department of Agriculture.

N. A. Whiffen, a chemical engineer whom many Americans have met during the last five years, has been chosen to head the laboratory. Mr. Whiffen leaves his post as science liaison officer of the Australian Embassy in Washington where he will be succeeded shortly by T. C. Bell. In his new position Mr. Whiffen will work under the Council of Scientific and Industrial Research. Until the new laboratory is completed he may be addressed at 314 Albert St., East Melbourne, Victoria, Australia.

The program of the new lab will include comprehensive studies all the way from the breeding of sheep through to wool processing and finishing, and developing a scientific basis for the wool textile industries. Since Australia supplies from 75 to 90 percent of all of the apparel wool of the world, the new organization will deal with projects of significant importance to the chemical process industries as well as to the textile groups.

Glass Process for Mosaics Developed in Russia

THE MAKING of smalto, colored glass used in mosaic work, a new product for Soviet glass-makers, is being developed in the laboratories of Glass-Making Faculty at the Leningrad Technological Institute, which is doing extensive research and product development work for the Russian glass industry.

First organized in Russia by the famous scientist M. V. Lomonosov in the middle of the eighteenth century, the making of smalto became a lost art in the USSR with the Leningrad

...with Transite Industrial Vent Pipe on the job

TRANSITE* Industrial Vent Pipe was selected for this laboratory venting system because it resists the corrosive effects of many vapors, gases, fumes . . . because it will provide effective and economical venting service for years to come.

Transite makes up into neat, efficient venting systems for a wide variety of industrial uses. As vents, ducts, stacks, this asbestos-cement pipe is quickly and economically installed . . . is light, strong and durable. It is readily workable—can be cut and drilled on the job. Rustproof, it needs no painting whether used indoors or out.

Transite Industrial Vent Pipe comes in a range of sizes up to 36" in diameter. The full line of Transite fittings meets practically any job requirement and assures a venting system which is corrosion-resistant throughout.

For further details, write for Data Sheet Series DS-336. Address Johns-Manville, Box 290, New York 16, N. Y.

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Typical industries in which Transite Industrial Vent Pipe is used:

Aircraft	Dairy	Gas	Petroleum	Shipbuilding
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Baking	Electrical	Laboratory	Pulp & Paper	Smelting
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Boiler Works	Farm Machinery	Leather	Railroad	Soft Drink
Brewing	Food	Meat Packing	Rayon	Sugar Refining
Canning	Foundry	Metal	Refrigeration	Textile
Ceramic	Furnace	Mining	Rubber	Tool
Chemical	Furniture	Paint	Sewage Works	Water Works

*Reg. U. S. Pat. Off.

Johns-Manville
TRANSITE Industrial Vent PIPE

Institute's research recovered the original technique. The colored glass product is being developed for decorative purposes, along with other new products under research.

Other phases of the Institute's work are studies in smelting of enamel on ferrous and non-ferrous metals, and development of sand-blast processing of glass to make artistic lattice, bas-relief and other decorative architectural units. The Institute has already developed a sort of technical enamel, described as particularly stable chemically, and colored decorative enamel on iron for interior and external finishing of buildings. On order from the Palace of Soviets construction agency, the Institute has worked out the technique of making large sculptures and bas-relief pieces from glass, weighing upwards of 154 lb. each. Research in polishing of sheet glass has given much help to engineers engaged in designing large automatic polishing-grinding machines.

Glidden Licenses White Lead Process in Australia

THE Glidden Co. has licensed the Euston Lead Co. Ltd., of Australia, to use the Euston process for the manufacture of white lead.

The Australian company has constructed a plant at Melbourne and will be in production by December or January. A. C. Hatrick, Australian manufacturer, negotiated arrangements with The Glidden Co. and is a director of the new firm.

Glidden is one of the country's largest producers of white lead, lithopone and titanium dioxide, the major white pigments. It owns exclusive rights to the Euston precipitation process and manufactures white lead at Scranton, Pa. Used principally in the making of paint and varnish, it also is important in the ceramic, linoleum, rubber and color industries.

India Moves to Relieve Fuel Shortage

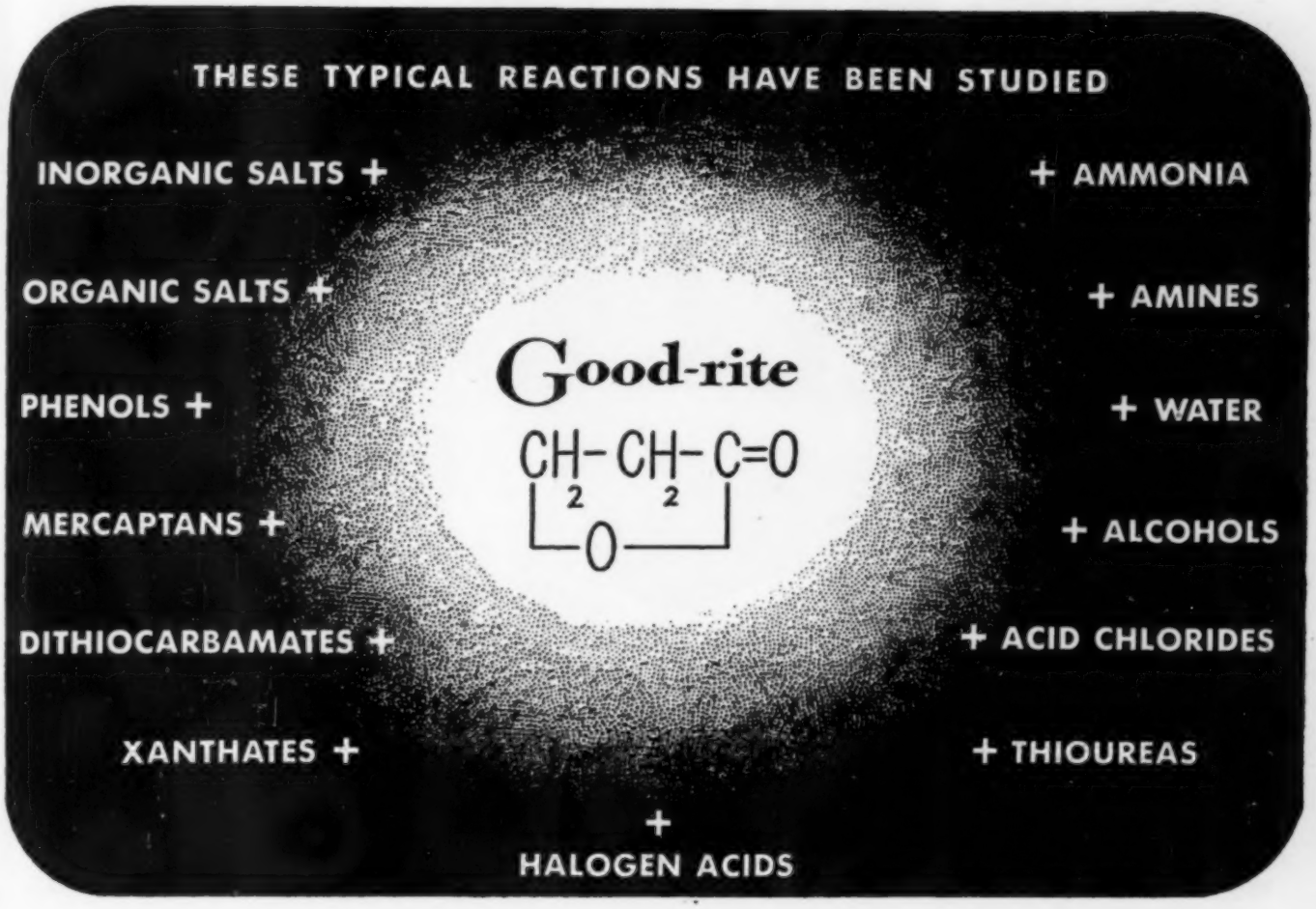
AT LEAST seven new alcohol factories based on sugar cane molasses are expected to go into operation next year. They will augment the critical shortage of gasoline.

North India's United Provinces plan two distilleries with a combined capacity of 2,700,000 gal. a year. In Madras, in south India, the provincial government is pushing plans for the establishment of five plants of still-undetermined capacity.

The United Provinces, one of the major sugar producing areas of India, already has plants with a combined

Now...Beta-Propiolactone

BEGINNING A NEW CHAPTER IN ORGANIC CHEMISTRY



HOW many other types of organic chemicals will react with Good-rite beta-propiolactone have not been determined! But its versatility as a basic chemical intermediate has now been firmly established. It has unusual chemical activity—it even reacts with sodium chloride. It makes commercially possible an ever-increasing number of organic chemicals never before practical. At the same time beta-propiolactone offers improved methods for commercial production of many industrial chemicals—in a variety of fields. A bulletin describing the properties of Good-rite beta-propiolactone may be obtained by writing to Dept. CD-10, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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RECOMMENDED FOR PRESSURES UP TO 1000 LBS. P. S. I.

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Series "H" Rotary
PUMPS

ENGINEERED TO DO THE JOB RIGHT!

Like all Roper pumps, Series "H" models embody simplest design and principle — yet have all the refinements necessary to assure dependable, economical operation under high pressures. Spur gears provide high volumetric efficiency, and operate in axial hydraulic balance. Roller bearings and bronze wear plates — two on each side — reduce friction for handling heavy loads. Hydraulic action continuously lubricates journal and bearings.

Roper Series "H" pumps are recommended for pressures up to 1000 lbs. p.s.i. when pumping lubricating oils . . . are designed to operate at direct motor speeds. They are used widely for all types of hydraulic mechanisms, steel mill equipment, and in oil field gathering line service. External relief valves are usually recommended for all high-pressure installations.

Send for Literature

Specifications and dimensions on series "H" and other models of Roper pumps are contained in illustrated booklet. Your copy awaits your request.

ROPER
Rotary Pumps

GEO. D. ROPER CORP., 150 Blackhawk Park Ave., Rockford, Ill.

capacity of 7,350,000 gal. per year. But railway transport problems, principally with relation to supply of coal, held 1947 actual production to about 2,000,000 gal.

Other major producers are the south Indian states of Mysore and Hyderabad, each of which has a distillery of 5,000,000 gal. annual capacity.

Large Plant to Reclaim Salts From Sea Water

A South African company has established a factory near Saldanha Bay to extract and process salts from sea water. It will begin production shortly. The plant reportedly will be the third biggest of its kind in the world.

The new South African industry will concentrate on the production of common salt in a few varieties, and output is expected to reach 6,000 tons a month. A very fine grade will be produced for the fat and margarine industries.

Second main product will be magnesium, of which, it is expected, 7,000 tons will be turned out in the first year. This quantity should be sufficient for South African requirements. It will also be used in the foundries for casting fine patterns for iron, brass and other metals.

The company will extract potassium salts. It plans to produce enough of these not only to supply agriculture, but also the match and other industries.

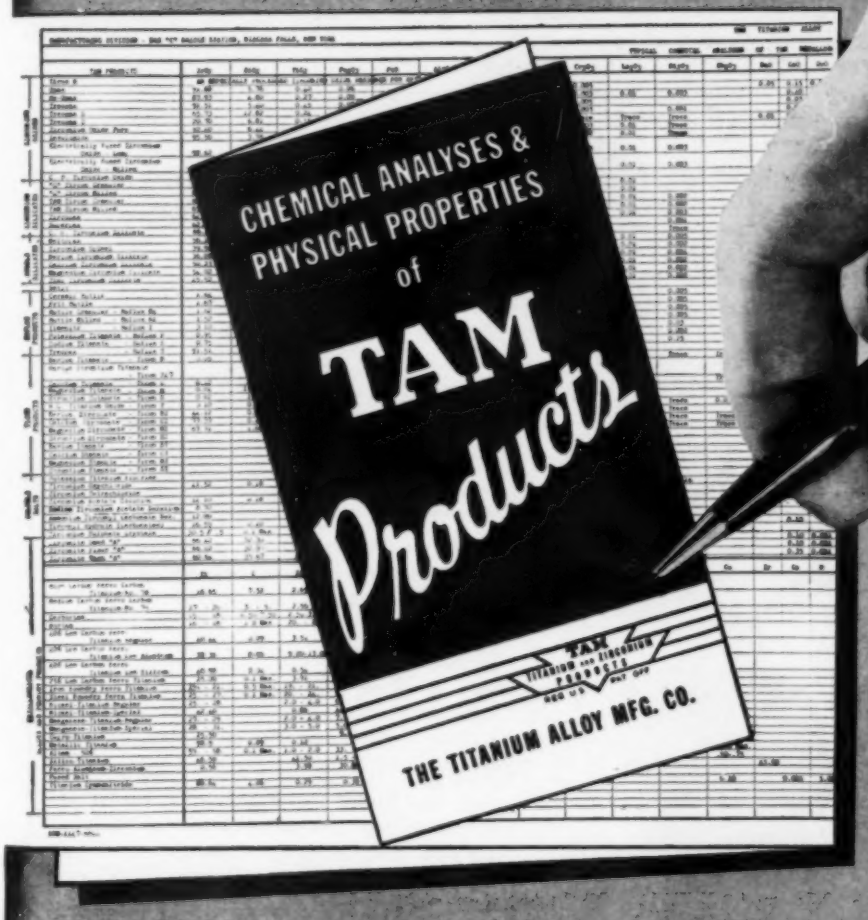
Fourth product of the new factory will be bromine, which will be manufactured in the form of salts and also in its free state. Salts will also be extracted from sea water for the manufacture of caustic soda, soda ash, potassium chlorate, potassium perchloride, bleaching powder and chlorine. About 6,000,000 gallons of sea water will be pumped daily into the plant during the first year. The quantity will be increased considerably later on.

New Zealand Pushes Ceramics Exports

During the next twelve months New Zealand expects to export £2-million worth of pottery and other ceramic products. The industry has set up sales representatives in Australia, South Africa, Canada and the United States.

A recent exhibition in Wellington included high-quality table and dinner ware, all types of hand basins, insulators and heavy industrial equipment, including paint mixers, spools for hosiery mills and large jars for acid storage. The smallest item was a tiny porcelain insulating bead weighing

Have the facts at your fingertips



With this compact folder, you can obtain information on TAMCO products readily. When you want approximate physical properties, a chemical analysis, or commercial applications of specific products—clear concise charts provide them at a glance. That's why you will want this helpful booklet whether you are interested in TAM ceramic, chemical or metallurgical products. Address your request to our New York City office.

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"BETTER BUILT FOR BETTER SERVICE"

For nearly seventy years Layne Well Water Systems have been recognized as the world's finest, but now and then we like to remind our friends—and ourselves of the reasons why. From pump head to screen point, every single part of a Layne Well Water System is definitely "Better Built for Better Service." Maintaining that highly essential standard, especially during material shortages, has not always been an easy task, but not once has a compromise been made.

Today, Layne Well Water Systems are actually finer in quality of materials, higher in efficiency and better in construction than ever before. This is particularly pleasing to the entire Layne organization, for it affords genuine satisfaction to have users well pleased.

The advantages of owning a well water system in which full confidence may be placed is too obvious for comment. An unfailing and adequate supply of water is of utmost importance. It is a matter of record that the fine quality of Layne Well Water Systems is remembered and appreciated long after the purchase price has been forgotten.

For further information, catalogs, bulletins, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

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WELL WATER SYSTEMS

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne Central Co., Memphis, Tenn. • Layne-Northern Co., Mishawaka, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northwest Co., Milwaukee, Wis. • Layne-Ohio Co., Columbus, Ohio • Layne-Pacific, Inc., Seattle, Wash. • Layne-Texas Co., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Minnesota Co., Minneapolis, Minn. • International Water Supply Ltd., London, Ont., Can. • Layne-Hispano Americana, S. A., Mexico, D. F.

1/12,000th of a pound, and the largest display was a massive 250-lb. porcelain electrolytic gold-separating bath.

The Canterbury Manufacturers' Association reports that porcelain switch gear is being exported in large volume to a big English electrical concern. And while Australia's utilities are trying to restore supply sources for porcelain insulators in Japan, New Zealand's total requirements are satisfied locally. The Association also reports that a large American concern is negotiating an order for Maori "souvenir" pottery.

More Chemical Plants Are Needed in Britain's Drive to Increase Production

BRITISH chemical exports in July reached an all-time record. At £7,580,000 they were still nearly £500,000 below the end-of-year target of £8,050,000, but the outlook is considered promising for the next few months. Fuel and power supplies are assured, and while the labor force has not risen in general, government insistence on higher productivity is beginning to bear fruit in the form of lower absenteeism and higher production per worker. Over-all production in the British chemical industry is believed to be rising at a rate of about 10 percent a year while the industry's man-power is increasing only slightly. Thanks to replacement of female labor by skilled men and to increased use of mechanical and automatic processes, the labor factor need not delay further expansion of chemical output.

More plant will be put into commission before the end of 1948 in several sectors of Britain's chemical industry. Among these will be the first cracking unit of the Petrochemicals plant at Carrington, Cheshire, though work was recently held up by a strike of building operatives. Bakelite Ltd. will put some of its new phenolic plastics plant at Aycliffe, Durham, into commission. British Drug Houses Ltd. is reporting normal operations in its new laboratory and fine chemicals factory at Poole, Dorset. British Nylon Spinners Ltd. at Pontypool, Monmouthshire, hopes soon to open its works, but full production will not begin this year. A new refractories plant is to be put into commission shortly by Steetley Lime and Basic Co. Ltd. at Cadeby near Doncaster. Brotherton & Co. Ltd. is erecting a large modern hydrosulphites factory at Bromborough.

New factories and plant extensions however still do not keep step with the

Light weight—only 20 pounds—makes the Pneumix easy for women operators to handle—easy to carry from batch to batch.

In addition, they are absolutely explosion proof, air powered by a motor that cannot overheat, or burn out through stalling. RPM can be regulated by air throttle control.

The ring guard stand shown is useful in breaking up thickened material before starting the agitating action.

Send for a copy of "Pneumix in Action"
Contains twenty-one pages of large size installation pictures, in a wide range of industries.

WRITE ECLIPSE AIR BRUSH CO., INC.
At Park & 14th St., Newark 7, N. J.

CUT BATCH MIXING COSTS
with
PORTABLE PNEUMIX AGITATORS

PNEUMIX DIVISION
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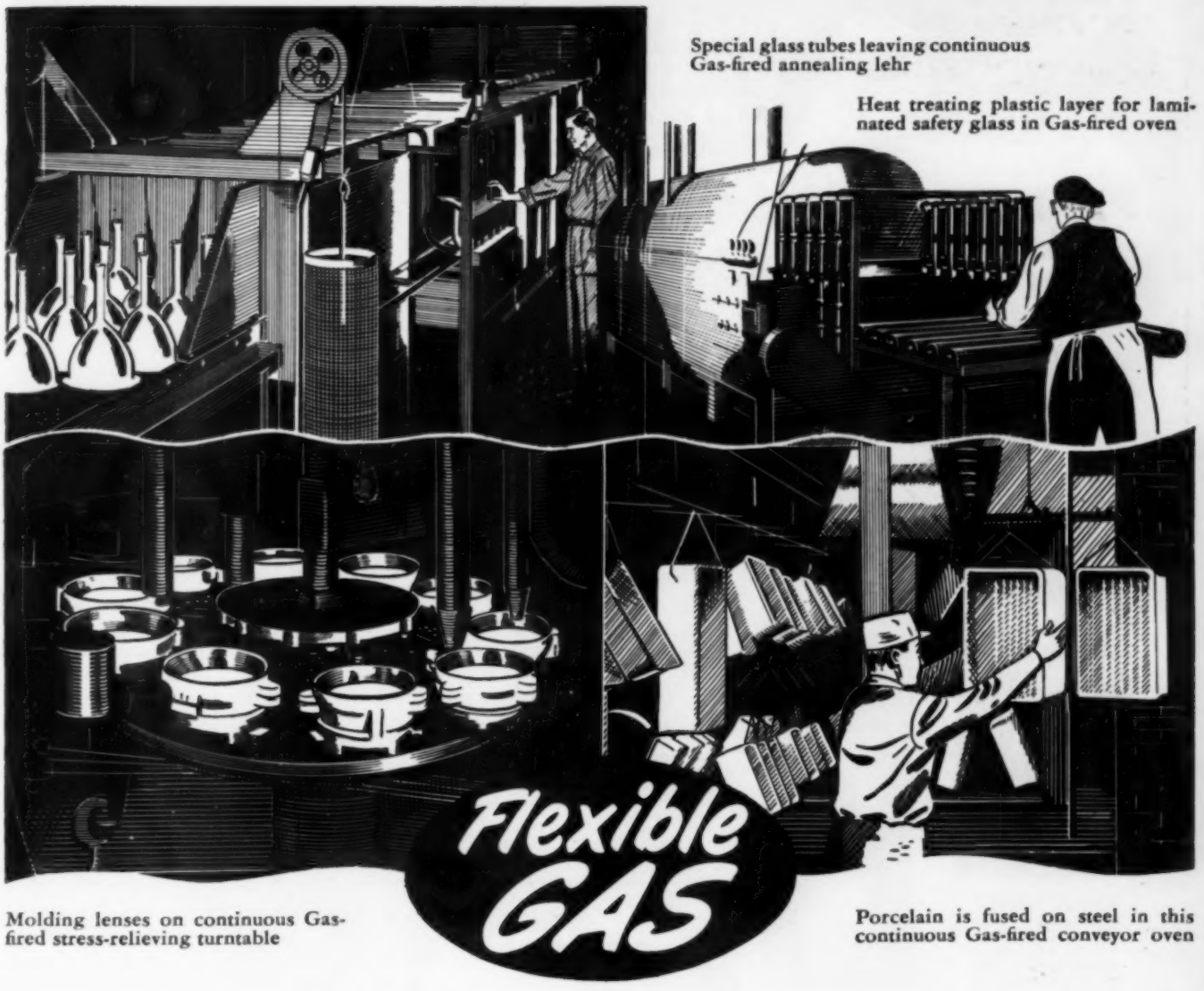

Special glass tubes leaving continuous Gas-fired annealing lehr

Heat treating plastic layer for laminated safety glass in Gas-fired oven

Molding lenses on continuous Gas-fired stress-relieving turntable

Porcelain is fused on steel in this continuous Gas-fired conveyor oven

Fulfills Every Heating Requirement

For GLASS and CERAMIC Productioneering

PRODUCTION-LINE heating operations, from melting-tanks to finishing processes, are natural tasks for GAS. In glass and ceramic manufacturing the flexibility of GAS is of primary importance because it can be applied regardless of the temperature or time-cycle required for any heating process.

Modern Gas Equipment is designed for use with existing machinery or in separate units which fit right into the production-line. GAS has established enviable records for economy and increased capacity in such glass and ceramic processes as—

- Continuous Annealing
- Stress Relieving
- Drying
- Frit Smelting
- Decorating Kilns
- Vitrifying Ovens
- Laminating
- Melting

Wherever heat is required in glass or ceramic manufacturing there's a task for GAS—and a place for modern Gas Equipment. You'll find it worth investigating.

You'll find modern Gas Water Heating Equipment worth investigating, too.

AMERICAN GAS ASSOCIATION

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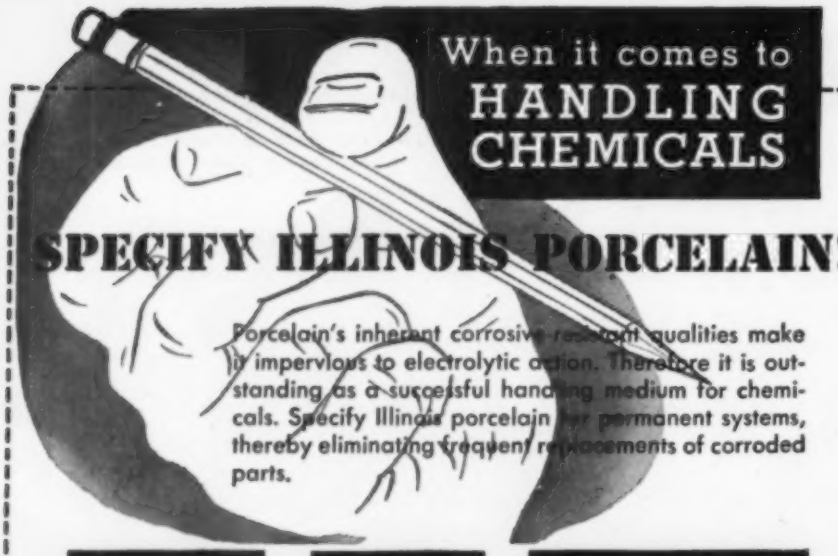
MORE AND MORE...

THE TREND IS TO GAS

FOR ALL INDUSTRIAL HEATING

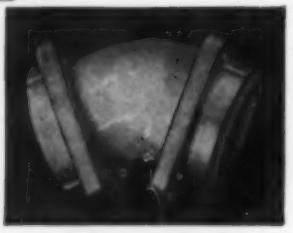


When it comes to
HANDLING
CHEMICALS

SPECIFY ILLINOIS PORCELAIN!

Porcelain's inherent corrosive-resistant qualities make it impervious to electrolytic action. Therefore it is outstanding as a successful handling medium for chemicals. Specify Illinois porcelain for permanent systems, thereby eliminating frequent replacements of corroded parts.

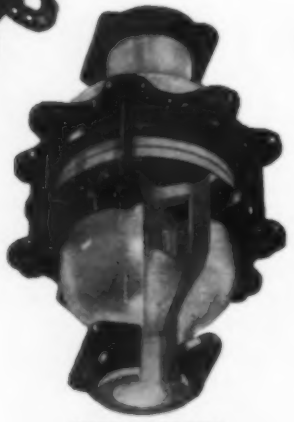
ANGLE VALVES
Available in all standard sizes from 1" to 6", these valves are designed for easy installation. Wherever an elbow can be removed, a valve can be installed because of exact dimensions.



PIPE AND FITTINGS
The inside and outside of all porcelain pipe and fittings are glazed white. The ends are ground true and smooth for gasket mounting. Flanges are accurately jig-assembled. Necessary bolts and nuts to make all connections are furnished for every joint.

WRITE
FOR
CATALOG C-2

Y-VALVES
Each Illinois valve has a very carefully ground and lapped valve seat which will hold chemicals at high pressures. Every valve is routine tested at 100 pounds pressure for a minimum of one hour to assure a perfect valve seat. Note that valve seat is located in lowest possible position to insure uninterrupted flow of material when stem is in open position. Packing is acid-resisting asbestos — graphite impregnated.



CHECK VALVES
Both vertical and angle check valves are porcelain to porcelain with no metal in contact with material being handled. Friction loss extremely low because ample space provided for flow around ball. Valve seat ground and polished to very close tolerances — ball is a polished sphere.

CHEMICAL
ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

increase of demand in many sections of the chemical industry. The alkali position remains tight, with little prospect of an appreciable alleviation before next year. Coal-tar products also continue in keen demand, but it has been noted that while the bulk of the output is disposed of regularly under long-term contracts, small lots have of late been offered more freely. Small price reductions for certain less important types of inorganic chemicals by leading makers have had the result of causing buyers to reduce their orders to a minimum in the hope of faring better by placing renewal orders later in the year. These expectations have not so far been fulfilled but have enabled many makers to work off order book arrears.

Control of Exports

How precarious the supply position still is in many fields has been demonstrated by the reimposition of export license control on dyestuffs and materials used in their manufacture. Acetanilide, acetic anhydride, benzoic acid, chloral, chloracetic acid, methylamine, oxalic acid, formaldehyde, formic acid and glycerine are all affected by the reintroduction of export licensing. This step was taken in the interest of preserving an adequate supply of dyestuffs for home users, especially the textile industry which is playing a more and more important role in the country's export drive, and of ensuring that exported dyestuffs are sent to the countries which give the best return in scarce foreign currencies or essential commodities.

The 10,000 long ton titanium pigment plant which the British Titan Products Co. Ltd. has been erecting at Grimsby, on the northeast coast of England, will probably start operations early next year—three years after government permission for erection of the plant was granted by the government. The new plant covers a 55-acre site, has cost over £1,250,000 so far, and is more or less self-sufficient. Sulphur and ilmenite will be imported from the United States and Norway respectively through the port of Immingham. Electricity will be obtained from the grid. Otherwise, the plant will rely entirely on its own resources. It possesses its own sulphuric acid works, the largest single contact unit in the British Isles, capable of a daily output of 110 tons of H_2SO_4. Next year British Titan Products Co. Ltd. expects to produce 12,000 tons of anatase type titanium pigment in its existing factory at Billingham and 10,000 tons of the latest rutile grade pigment at Grimsby. At present more than half the company's output goes into the paint trade. Grimsby is also the locality chosen for

"Spit tobacco juice, or die"

DNOC (dinitro-orthocresol)

may banish grasshopper plague

To millions of kids a grasshopper may be just a quaint "bug" which "spits tobacco juice" or makes passable bait for fish hooks. But to others all over the world, grasshoppers are destroying pests which annually devour millions of dollars worth of food crops.

Grasshopper *control* is a vital issue to farmers everywhere!

Now, the *Pittsburgh* chemical DNOC (Dinitro-Orthocresol) promises to become the most effective insecticide for grasshopper control yet developed. It has excellent mixing qualities with inerts and the general stability desired for agricultural uses.

DNOC is one of a variety of agricultural chemicals, including insecticides, fungicides, germicides and rodenticides, produced by Pittsburgh Coke & Chemical Company for its affiliate Pittsburgh Agricultural Chemical Company, Empire State Building, 350 Fifth Ave., New York 1, N.Y. Address inquiries about *agricultural chemicals* to the above.

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Benzol—Motor, Nitration, Pure
Creosote
Cresol—Meta Para, Ortho
2,4—Dichlorophenoxyacetic Acid
Dinitro—Orthocresol
Isopropyl N—Phenyl Carbamate
Naphtha, Heavy Solvent
Naphthalene
Para Amino Phenyl Mercuric Acetate
Phenol
Phthalic Anhydride
Picoline—Alpha, Beta and Gamma
Pipe Line Enamel
Pyridine—Medicinal and Industrial
Sodium Cyanide
Sodium Thiocyanate
Sulphate of Ammonia
Sulphuric Acid—60°, 66° and Oleum
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there is a difference!

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STANDARD
1/8" TO 3"
Cold-Working Pressure up to 2,000 pounds.

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The Catawissa seat design gives you a perfect seal for every installation -- even when the pipe is not properly aligned -- with its 55-degree angle on the female end to a ball on the male end!

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ESPECIALLY ADAPTED FOR HIGH TEMPERATURE & HIGH PRESSURE SERVICE!
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See your industrial supply distributor -- or write direct for a copy of BULLETIN 10-A

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CATAWISSA
UNIONS ★ VALVES

a new titanium oxide factory by National Titanium Pigments Ltd. Imperial Chemical Industries Ltd. has carried out the intended issue of new ordinary shares at a price which provides the company with an additional £20,000,000 of capital. Supplementing the information provided earlier, the company stated in connection with the share issue that at the end of last year specific projects entailing a total expenditure on new capital construction of £52,000,000 had been sanctioned by the board of directors. This figure compares with a sum of £13,550,000 invested last year by the company and its subdivisions in new plant and extensions and with semiofficial forecasts of a total expenditure on new plant and extensions within ten years of £120,000,000. It would thus apepar that the ICI. combine has already planned its investment program in detail for three or four years ahead. The new capital obtained now however covers only part of this expenditure. The remainder will have to be provided out of retained profits which for nearly 20 years were the only source of finance for expansion projects and, possibly, out of further capital issues.

Australian Expansion

Imperial Chemical Industries of Australia and Newland Ltd. in which the British ICI. had a 64 percent interest has just announced a large expansion program of its own, estimated to cost about £A4,000,000. Most of this sum will be spent on additional production facilities for alkalies, explosives and plastics for local use. Next to India and Pakistan, Australia is the largest export market for British chemicals, and various other firms for whose products Australia offers a large outlet have made preparations for production on the spot. Thus British Titan Products Co. Ltd. is building a titanium pigment factory in Tasmania. The British Oxygen subsidiary has large development schemes in hand in various parts of Australia. Lewis Berger & Sons Ltd., the paint manufacturers, have commenced work on two new production units in the southern continent, and other British paint and drug manufacturers have also drawn up schemes for the expansion of their manufacturing, packaging and marketing organizations in Australia. These are being encouraged by the Australian government, and special facilities have been offered for the transfer of skilled British workers to new Australian factories.

The demand for chemicals used in the rayon industry is likely to be affected in the long run by the curtailment of the expansion program of the leading company in this field. Court-

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INFRARED HEAT

with the improved, all-Metal

CHROMALOX

Radiant Heaters

The speed, economy and dependability of infrared heat for baking, drying and heating are well known.

Now—to broaden the uses for infrared heat, CHROMALOX Engineers have designed the all-metal, heavy-duty CHROMALOX Radiant Heater that withstands shock, vibration, dust and moisture . . . that operates efficiently in low *and* high ambient temperatures . . . and that provides glareless infrared radiation in the longer wave lengths which are absorbed almost equally well by all colors, textures and types of surfaces.

Check these Points...

FLEXIBLE APPLICATION — CHROMALOX Radiant Heaters are used in line-production or stationary applications requiring baking, preheating, dehydrating, curing, mass heating, drying or similar processing. Units may be mounted individually or interlocked to form banks, tunnels, ovens, etc., of any desired shape and length.

HIGH EFFICIENCY— Specially designed Inconel sheathed, CHROMALOX Tubular elements, accurately located in the parabolic reflectors, assure uniform, even heat without hot spots. Alzak, non-tarnishable reflectors direct infrared heat rays with maximum efficiency.

GLASSLESS, ALL-METAL CONSTRUCTION—Extruded aluminum body results in more rugged units that take rough handling without damage; danger of glass breakage is eliminated. Units are compact (only 4 inches deep) and come in nominal lengths of 2, 2½ and 4 feet.

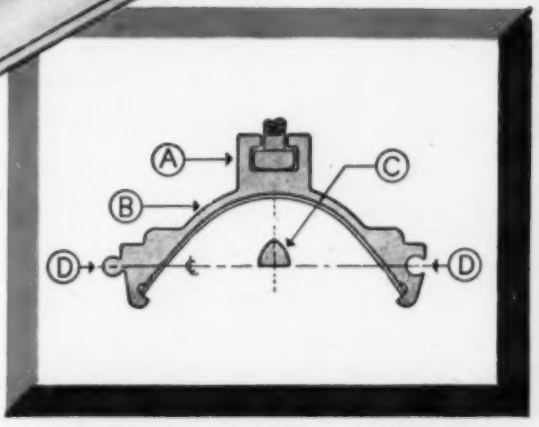
Write for Complete Information

For Specification and Application Data, request Bulletin No. CS-601

CHROMALOX

Electric Heat for Modern Industry

EDWIN L. WIEGAND CO. · 7514 THOMAS BLVD., PITTSBURGH 8, PA.



Designed for Maximum Efficiency, Easy "Interlocking" Assembly, Simplified Installation.

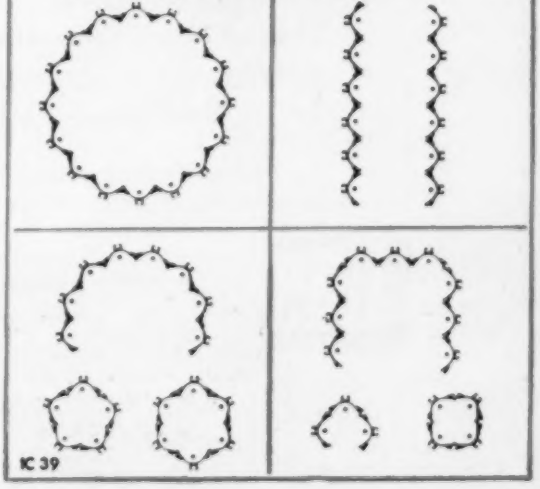
A: Mounting channel has two adjustable captive bolts per section for quickly mounting Chromalox Radiant Heater into position.

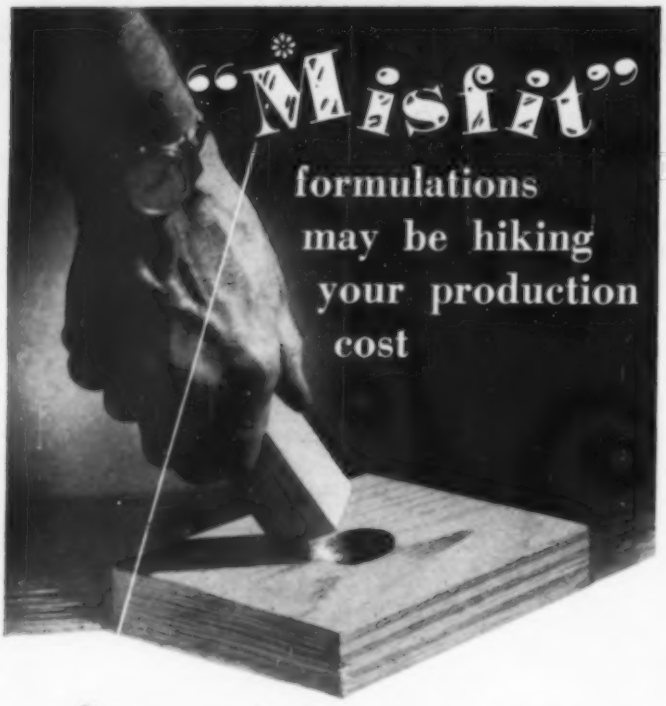
B. Extruded aluminum body designed for greatest structural stability, minimum weight; Alzak parabolic reflector fits into grooves in body, is independently replaceable if damaged.

C: Heat source is specially designed Inconel sheathed, triangular cross-section Chromalox element located at the focus of reflector to give maximum direct and reflected radiation.

D. Units are quickly interlocked length-wise; joined sections form a "hinge" joint which permits rotation up to 25° from a straight line.

A few suggested arrangements:





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Latex Concentrates
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aulds Ltd. has abandoned its intention of erecting an acetate rayon factory at Sellafield, West Cumberland, and a viscose rayon staple factory at Easthaven, near Dundee, Scotland. The company has also had to give up the plan of building a photographic film base factory, in cooperation with the Gevaert Company of Belgium, at Norwich, so that the expansion work under progress at present is largely confined to extensions to existing factories. The only new plant now being built by Courtaulds in England is a plant for the production of a strong viscose rayon yarn for use in the manufacture of tires at Preston, Lancashire.

Australian Plant is Using Shawinigan Carbon Process

ELECTRONIC INDUSTRIES LTD., Melbourne, is producing acetylene black for dry batteries under an arrangement with the Canadian firm, Shawinigan Chemicals Ltd. Capacity of the Australian plant is 600,000 lb. a year.

Shawinigan retains the right to supply the requirements of Eveready (Australia) Pty. Ltd. direct from Canada.

Electronics Industries has entered into an arrangement with the Commonwealth Carbide Co., Electrona, Tasmania, to operate an acetylene black plant near the carbide factory. The expense of shipping the crude carbide to the mainland for processing is thus being saved.

Since Electronics Industries does not expect to compete with Shawinigan in supplying Eveready's Australian branch plant, and would hardly be in a position to do so because of the lower cost of carbide in Canada, the firm has gone into partnership with General Dry Batteries Inc. to set up a jointly owned subsidiary for production of high grade dry batteries in Australia.

An interesting point is that the Australian acetylene black plant is the only one of its kind in the world outside of Canada. The Union Carbide Co. and its subsidiary, the National Carbon Co., do not themselves produce acetylene black but buy it from Shawinigan. Eveready (Australia) Pty. Ltd. is a subsidiary of National Carbon.

ICI and Tata May Soon Reach Long Expected Agreement

THE LONG-DEFERRED agreement between the Tata industrial combine and Imperial Chemical Industries Ltd. for the establishment of a domestic dyestuff industry is expected to be closed shortly. The scheme, long confined to

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Translucent Flexible Plastic—Strong, Easy-draping, Light in Weight—Easy to Clean

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EVERY SEAM ELECTRONICALLY WELDED . . . ADJUSTABLE PLASTIC STRAPS ARE WELDED TO GARMENT AND WON'T PULL OFF!

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428 E. Pearl St., Cincinnati 2, Ohio

paper, calls for the production of up to 90 percent of India's dye requirements within 10 years.

The proposal fits into the government's plan to double India's steel production to 2 million long tons annually, for one result will be the doubling of the country's output of coal tar from the high-temperature distillation of coking coal to produce metallurgical coke.

At present India is spending about $12,000,000 annually to import dyes for her textile industry.

Czech Chemical Exports Pushed as Raw Material Imports and New Facilities Swell Output

EXPORT of chemical products from Czechoslovakia is steadily increasing—in 1947 the chemical industry's share of the nation's exports was about 3.4 percent. This figure represents an increase of 67 percent compared with 1946, and for the first quarter of the current year the figure is 30 percent greater than over the corresponding period of 1937.

According to preliminary figures of Czechoslovak foreign trade, chemicals valued at more than $44½ million were exported in the first four months of 1948.

In addition to direct exports, the chemical industry also has a considerable indirect export trade as its products are included in exports of glass, metal goods, textiles, leather and rubber goods. All contain or are treated with chemical products.

Of course Czechoslovakia is an important buyer of chemical raw materials—coal being the only material which is here in any quantity—and also purchases finished chemical products.

Some 800,000 to 900,000 tons of the principal raw materials are annually imported. These include pyrites, phosphates, salt, oil distillation residues, lubricating oils and various pharmaceutical raw materials.

A deposit of Ilmenite (titanium dioxide) of excellent quality has been located near Pilsen. Up to the present, Czechoslovakia has been importing titanium white from Sweden.

Stalin Synthetic Fuel Works at Most has recently begun the production of a new synthetic material named "Stalit." The plastic comes in four colors: black, red, brown and natural, and is being sent to local factories for fabrication.

Another byproduct from the Stalin Works, gas, will soon be going by long-distance main to the black coal mining town of Kladno, where the instal-

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RED CYPRESS
Tidewater Red Cypress serves better and lasts longer. It's natural resistance to acids, alkalies, etc. insures long and satisfactory results when used in vent stacks, pickling troughs, electroplating vats, etc. It's use under these conditions truly confirms its claim to being "The Wood Eternal".
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"Without doubt, YARWAY Steam Traps are finest traps ever built. All trap replacements will be YARWAY hereafter."—Oil Company, Texas.

Cleaning Plant

"As soon as we installed the YARWAY trap our trouble ended. Since then, when other traps gave trouble, we put in YARWAYS and they always did a much better job. Now we use all YARWAY traps," says Maintenance Engineer of large mid-western cleaning firm.

Dairy Company

"YARWAY Traps have been a life-saver here. Used many different makes before trying YARWAY a year ago. Haven't touched them since. Trying to get management to buy more."—Large Wisconsin dairy.

Dye Works

"Use a good many YARWAY Traps here—like them very much on dryers. Take up little room and discharge condensate as fast as it comes through the line, causing coils to heat up faster and hold steady temperature."—Globe Dye Works, Philadelphia, Pa.

SPEAKING OF STEAM TRAPS

Laundry

"Ironer is so hot it sizzles after putting YARWAY trap on in place of a bucket trap. Run heavy spreads through ironer once and they are dry. Pulling out all bucket traps and will replace with YARWAYS."—Farina Laundry Co., Vancouver, British Columbia.

Power Station

"A great many YARWAY Traps are used here and have been very successful... some of these traps have been in use since 1939 and have given absolutely no trouble."—Herkimer Municipal Power Station, Herkimer, N. Y.

Florist

"Coal bill last winter was $5,000 less than previous winter. Didn't know whether they could give YARWAY Traps all the credit, but they were entitled to a big share of it."—Meyers and Santman (Greenhouses), Wyndmoor, Pa.

Hospital

"Ten years ago replaced an.....trap with a tiny ½" #60 YARWAY on an ironer. Never had such good results before. Trap has never been opened and still going 100%. Since then have bought nothing but YARWAY Traps and will specify them for new addition."—Northern Wisconsin hospital.

Textile Plant

"One large press formerly equipped with a bucket trap wouldn't heat lower platen. A ¾" YARWAY Trap was installed and since then full production has been maintained. This represents an increase of 20% in production."—Southern textile mill.

ACTUAL SIZE
½" TRAP

NEARLY 600,000 BOUGHT!

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ROTOJETS are made in pipe connection sizes from ⅛" to 2½".

Redesigned to embody latest improvements, Binks famous Rotojet Spray Nozzles set a new high standard in spraying efficiency! Constructed on the off-center inlet, whirl chamber principle, Rotojet nozzles provide fine, uniform fluid break-up and distribution at pressure as low as 7 lbs. Nozzles are precision-machined from tough, marine bronze, stainless steel or any special alloys that are machinable from bar stock. Internal surfaces are smooth and free from vanes and other obstructions. Available in a wide variety of sizes and capacities.

Send today for technical bulletins describing Binks ROTOJET Nozzles.

Bulletins give full information on sizes and capacities of the following Binks Rotojet Nozzles:

Bulletin Numbers:

10. Small and Medium Capacity Nozzles
11. Nozzles for Brine Spray Cooling
12. Large Capacity Nozzles
14. Nozzles for Metal Cleaning Operations.

Please state how nozzles will be used, and give capacity of installation.

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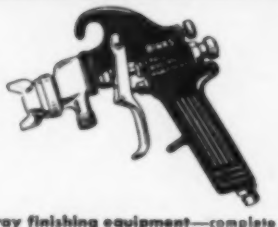
OTHER BINKS PRODUCTS YOU SHOULD KNOW ABOUT

Cooling towers — natural draft and mechanical draft, of all capacities.

Heat exchange coils—for use in closed type cooling systems.



Spray finishing equipment—complete for all types of finishes.

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REPRESENTATIVES IN ALL PRINCIPAL CITIES

lation of street mains is practically completed. The important Bohemian industrial towns of Liberec, Jablonec and Semily Jicin also will be fed with gas from the works.

A dye works, the most modern of its kind in Czechoslovakia, has just been built at Svit, in Slovakia. (This industrial center was built during the war and consists mainly of a large Bata factory.) The works have six sets of plant for dyeing fabric and employ over 100 workers. The chemcials needed will be obtained partly from Switzerland and partly from Zilina, Czechoslovakia.

Softwood Shortage

The Czechoslovak cellulose and paper industry is suffering from a chronic shortage of pine and fir. At present experiments are being made for the first time in Czechoslovakia at the Vranov Timber Works in Eastern Slocakia to produce chemical cellulose and other cellulose products from hard wood. If this proves successful it would be of great assistance to the paper and cellulose industry.

Dr. Holy, General Director of Czech Leather & Rubber Factories and of the Bata Works, has been negotiating with Polish economic representatives in Warsaw. Mutual trade relations, exchange of goods, the obtaining of raw materials, exchange of technical experience in the leather and rubber sector, and the common training of young workers were the subjects under discussion.

Czechoslovakia will be supplying part of the machinery for the first Polish factory for the manufacture of tanning extract. This factory will be built at Bydhost. Its yearly output will be 3,000 tons of tanning extract.

The Czechoslovak chemical industry is arranging for permanent representation in Warsaw where it will also have distributing warehouses. Representatives of the Czechoslovak and Polish chemical industries are making plans for cooperation both for this year and 1949.

Dr. Matyas Lewinter is now the new general director of the Czech Glass Factories. He is a specialist and expert who has done a lot of reorganization of the glass industry on the technical side. Dr. Lewinter has been interested in the new production processes for technical glass, and has introduced a number of technical novelties into the Czechoslovak glass industry, which previously had been imported.

On May 1, production of artificial silk began in the largest works of this kind in Poland, situated in Zydowicy, a suburb of Stettin.

Under the recently concluded

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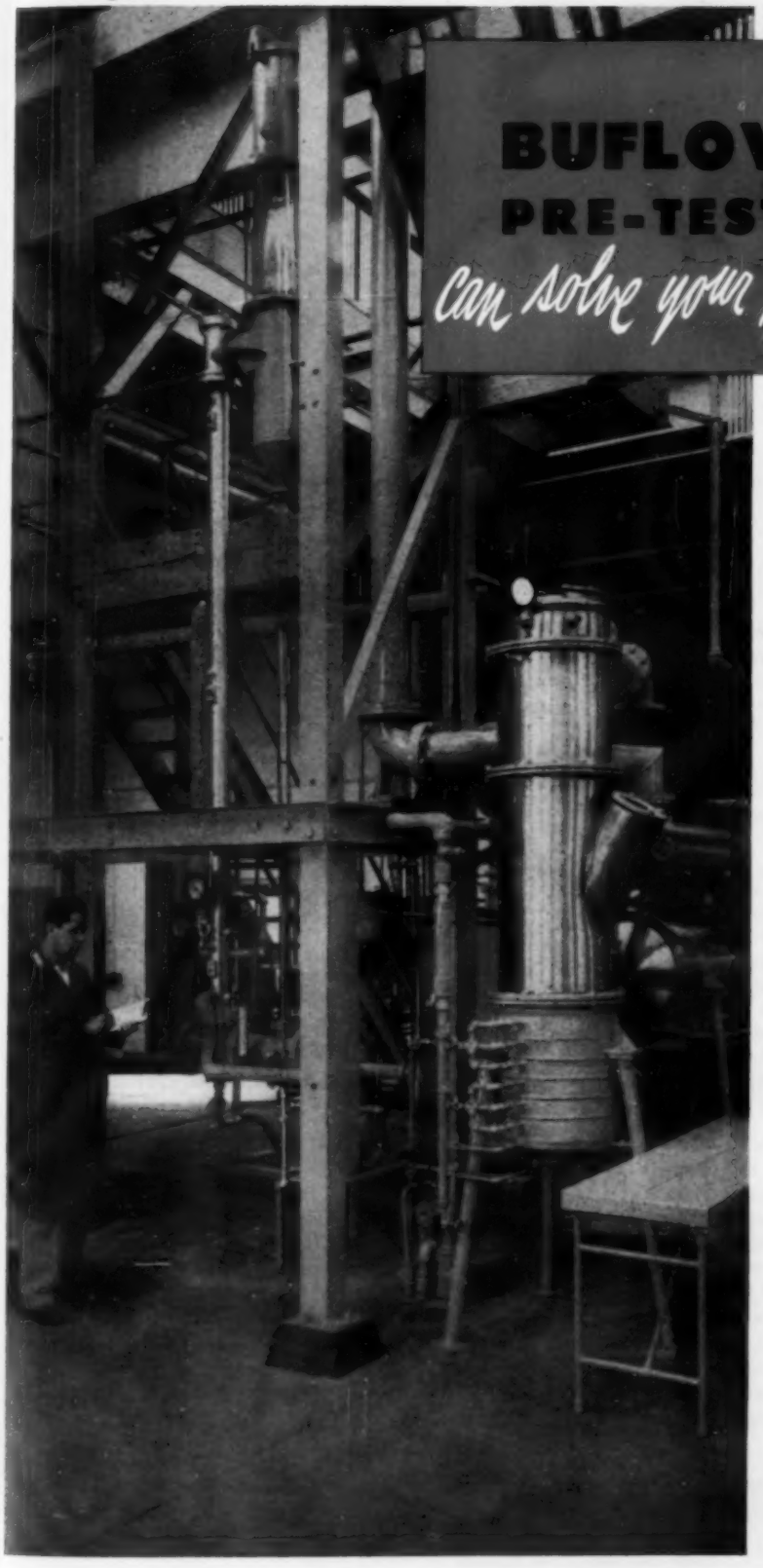

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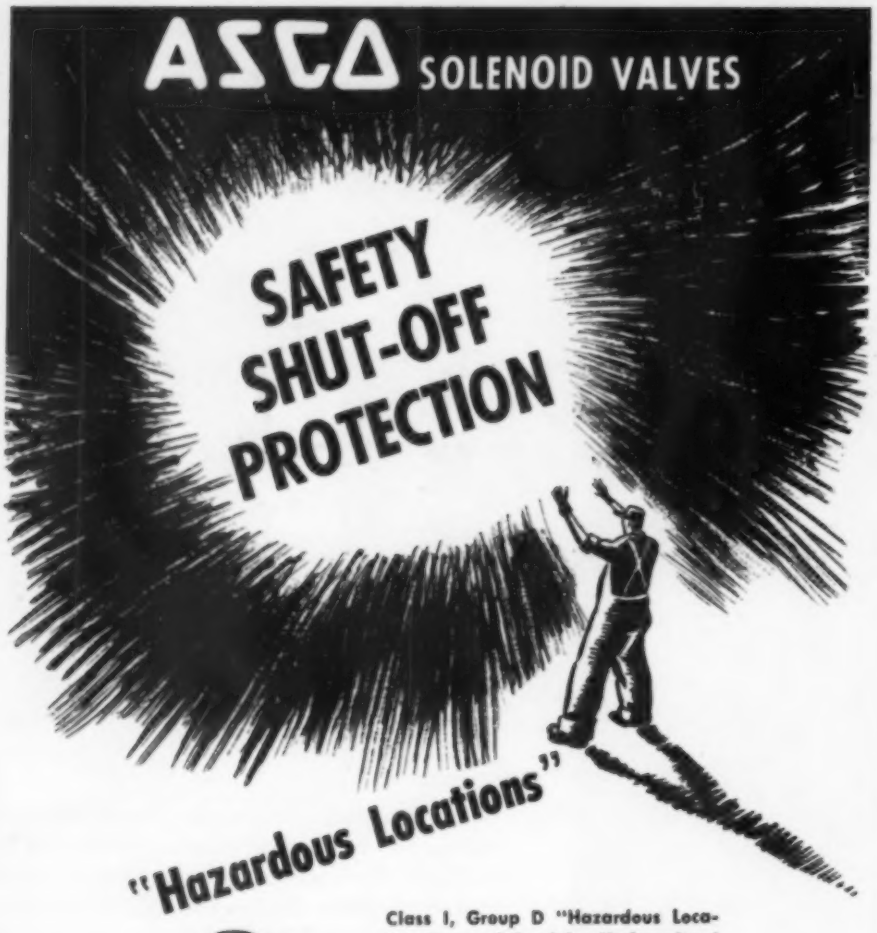

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packless, used with push button reset relay for remote manual resetting; Factory Mutual approved.

Bulletin 8020
free handle manual reset, safety shut-off valve; for air and non-corrosive gas; Factory Mutual approved.

Class I, Group D "Hazardous Locations" are defined by Underwriters' Laboratories as "atmospheres containing such materials as gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors and natural gas."

This calls for the Explosion Proof design of solenoid valve for Safety Shut-off purposes. We have a variety of such valves which are designed to protect operators, lines and process equipment when an instantaneous closing in "an emergency" is imperative. They are positive in action and of the manually reset type. These ASCO Safety Shut-off Solenoid Valves come in sizes up to 6 inches and for pressures up to 250 pounds. They also can be furnished to operate in reverse, that is, to open in emergency and stay open until closed manually.

Where you have a flow of gas or liquid that must be stopped — or started—instantaneously in emergency, your best bet would probably be a shut-off solenoid valve . . . and the design and manufacture of solenoid valves is our business.

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

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trade treaty between Poland and the USSR, the Soviets are to supply Poland with a completely equipped works for the production of fertilizers, carbide, and phenol. The Polish chemical industry will considerably increase its output with the opening of six new factories for the production of the most important chemicals. The Soviets are also supplying a large carbide furnace, to be installed in a factory for organic byproducts at Dvory, near Oswiecin (Auschwitz).

ICI Has New Antidote For Sleeping Sickness

EARLY results of tests in Central Africa of a new drug, M. 7775, developed by Imperial Chemical Industries' Dyestuffs Division research laboratories in Manchester seem to establish the drug's effectiveness against sleeping sickness in cattle.

Tests will continue for several more months, but Dr. D. G. Davey, one of ICI's ace biologists and part of the team which discovered "Paludrine" (synthetic anti-malarial drug) during World War II, who is responsible for the research which led to the new antidote, said in Khartoum last June that he expected the drug to produce an immunity lasting at least six months.

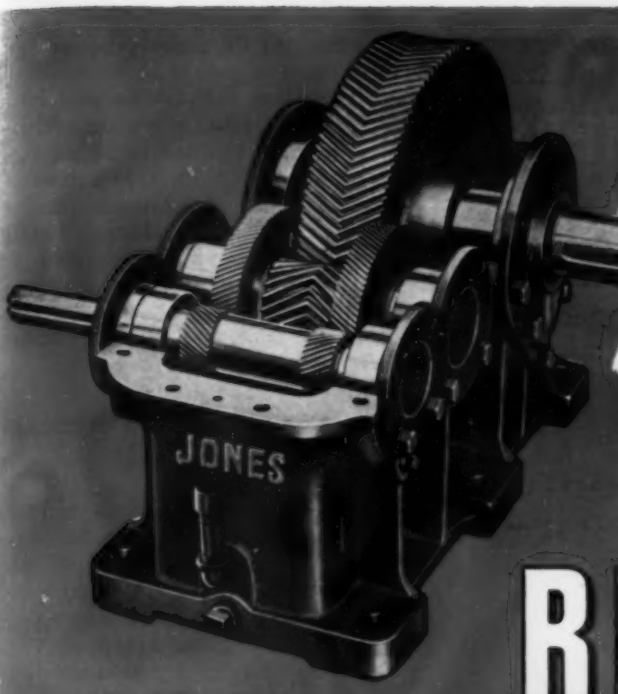
If these hopes are realized, the drug would help open up vast fertile areas in Central Africa (at present plagued by the tsetse fly) into a huge beef-producing area and render the United Kingdom considerably less dependent on imported beef from the Argentine and elsewhere.

(ICI in London says Dr. Davey spoke prematurely and they are not willing to divulge any more details at this time about the drug itself. However, they did state positively that it is an entirely new drug, and is not *thenatrididium*—a May & Baker product—nor does it resemble it. Expect more details in about three months.)

Australia Gets Big Bitumen Plant

ONLY plant in the world, according to Shell officials, which produces steam-refined bitumen and three neutralized side streams for production of lubricants in one process has been completed by the Shell Co. of Australia Ltd. on a 250-acre site at Clyde, New South Wales.

The plant cost $5.4 million to build and is capable of treating 100,000,000 gal. of crude oil annually. This exceeds the aggregate capacity of all Australian refineries, existing and planned. Consequently, for many years to come Shell expects to handle more than



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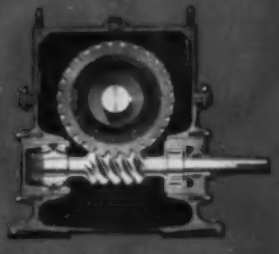
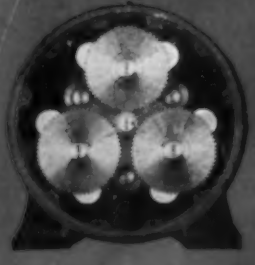


WORM GEAR REDUCERS
Ratios 4 to 1 up to 90 to 1 in capacities from ¼ to 100 H.P.



SPUR GEAR REDUCERS
Ratios 5-1/3 to 1 up to 200 to 1 in capacities from ½ to 75 H.P.

When you want a speed reducer you want the type that will best handle your particular drive problem . . . and you want a reducer that will "stand the gaff." Jones reducers measure up to both of these standards.

It makes no difference whether you require herringbone, spur or worm gear reducers, the Jones organization can give you just what you need in any ratio and capacity . . . and over the years Jones reducers have shown the ability to "take it" under the most severe operating conditions.

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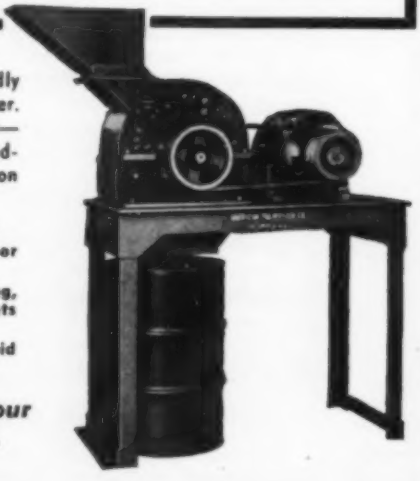

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50 percent of the refinery business in Australia.

The refinery runs off finished bitumen within 24 hr. after crude-oil intake, which is claimed to be another record. It will yield 35,000 tons of bitumen a year. A lubricants refining section capable of producing 10,000 tons of high-grade lubricants from the side streams is still under construction. The whole installation is designed to operate on Venezuelan crude.

New Glass Works in Armenia Uses Electric Furnace

SOVIET UNION'S first glass works in which the smelting process is based on an electric furnace, instead of the usual gas furnaces, has been established at Erevan in Soviet Armenia.

Designed by three Armenian engineers who have developed a new thermoelectric process for glass making, the furnace is stated to result in large fuel economies, acceleration of the production process and improved quality glass. The plant produces window glass, and has already put out its first 50,000 sq. m. (about a half million sq. ft.) of glass.

Erected by local engineering talent, the plant is described as simple in design and reliable in operation.

India Needs Large Amounts Of Process Equipment

INDIA will need $600,000,000 worth of machinery and capital goods from America in the next five years—including $30,000,000 worth of chemical plant—if she is to keep up with her ambitious industrial development plans.

This official estimate is to be the basis of all discussions between Indian representatives in Washington and American officials. Biggest obstacle, Indian officials feel, is American export quotas which now stress European recovery to the virtual exclusion of other parts of the world.

New Paper Mill for Tasmania

DIRECTORS of Associated Paper & Pulp Mills Ltd., Burnie, Tasmania, have announced that arrangements have been concluded with Thomas Owen & Co., the British paper firm, to establish a paper mill on a site adjacent to Associated's plant. The mill will produce vegetable parchment, greaseproof glassines and other specialty papers. The new company will have a nominal capital stock of £3,000,000 ($9,600,000).

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Knowing how is simply the sum of experience, resources and imagination, put into the job of doing something better.

Niagara Alkali Company pioneered the electro-chemical industry in America. Niagara continues to extend the know-how gained in this pioneering work to the many users of Niagara Caustic Soda, Caustic Potash, Carbonate of Potash, EBG Liquid Chlorine, Paradichlorobenzene and Niagathal (Tetrachloro Phthalic Anhydride). May we serve you?

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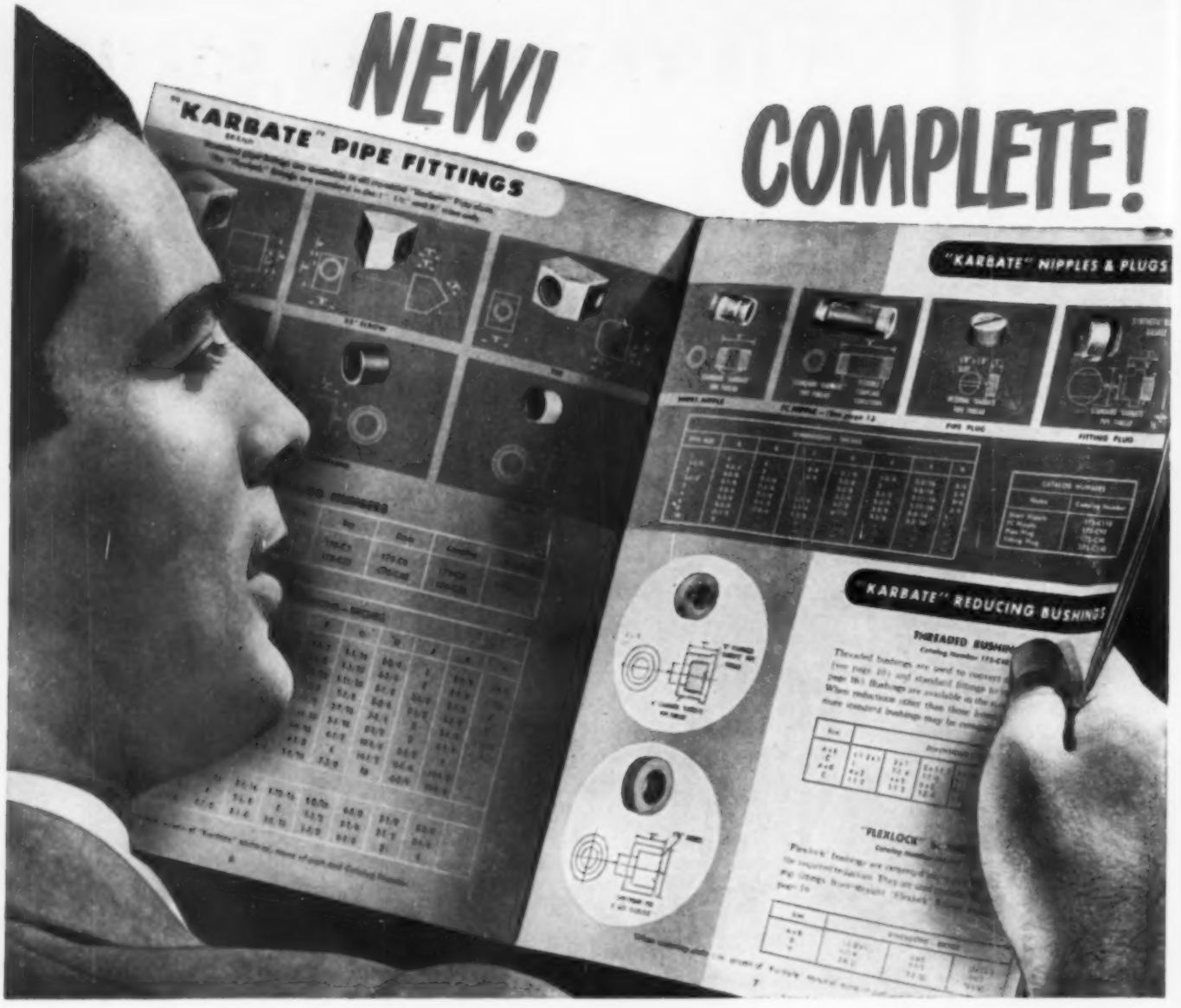

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- **How to select** the proper grade of "Karbate" Impervious Graphite or "Karbate" Impervious Carbon equipment to handle acids, alkalis, salts, halides, organic compounds, or mixtures presenting corrosion problems.
- **How to order** "Karbate" brand pipe and fittings directly from the complete tables fully covering sizes, grades, and designs.
- **How to install** "Karbate" pipe and fittings, including instructions on machining, cementing, serrating, threading, and coupling.

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Industrial Alcohol versus Construction Materials

Part II of a two-part symposium in which a representative group of construction materials are evaluated for services involving industrial alcohol.

RUBBER

O. S. TRUE
United States Rubber Co.
New York, N. Y.

NATURAL rubber compounds, both hard and soft, are only slightly affected by ethyl and methyl alcohol at temperatures up to the boiling point of the solution. Perbunan, Hycar, butyl, neoprene and Thiokol compositions may also be used in the presence of alcohols.

We have no commercial demand for rubber linings to handle alcohols as such. In certain instances alcohols have been present as impurities. In services where alcohols have been present as impurities, natural rubber linings have been successfully used.

STAINLESS STEEL

W. G. RENSHAW
Allegheny Ludlum Steel Corp.
Brackenridge, Pa.

THE STAINLESS steels are widely used in applications involving alcohol, both in the industrial alcohol field where chemical purity of the product is essential and in the beverage industries where strict sanitation and cleanliness requirements must be observed. A wide number of compounds come under the classification of alcohol, but most important is ethyl alcohol and in this field stainless steel has been satisfactory in numerous applications.

Stainless steel grades in the 300 series (chromium nickel) and in the 400 series (straight chromium) can handle the alcohols at almost all temperatures. Type 304 (0.08 max. C, 18-20 Cr, 8-10 Ni) is probably most commonly used for such applications.

At elevated temperatures and boiling, methyl alcohol tends to oxidize to formaldehyde or formic acid in the presence of air. In some instances pitting of Type 304 has been encountered at the air line with hot methyl alcohol. Type 316 (0.10 max. C, 16-18 Cr, 10-14 Ni, 2-3 Mo) offers better resistance to pitting in such cases.

In the manufacture of ethyl alcohol, rectifying stills, columns, heat exchangers, condensers and piping have been made of Type 304. Type 430 is often suitable for some of this equipment. In the production of absolute alcohol the stainless steels are also useful except in instances where certain dehydrating agents such as zinc chloride might be used.

Type 304 is used extensively in the brewing and wine industries. Fermentation vats, rice cookers or mash tubs, storage vats and barrels of Type 304 are used in the brewing and transportation of beer. In wine industries, Type 304 and Type 316 have been frequently used. (Type 316 is more suitable where sulphur dioxide is present in the wines because this type offers better resistance to pitting.)

Stainless steel is not affected by whiskey, but in some instances whiskey has become cloudy when stored in stainless steel, probably due to some catalytic effect of the metal. Stainless steel is rarely used in this application.

SILICONES

J. A. McHARD and LEON VAN VOLKINBURG
Dow Corning Corp.
Midland, Mich.

SILICONE products are generally insoluble or only partly miscible in polar solvents. Such behavior is due largely to the hydrophobic nature of organo-silicon oxide polymers. Silicone treated surfaces, for example, are completely non-wetting to water or aqueous solutions. Similarly methanol and the polyalcohols have practically no solvent effect on silicone fluids, resins or Silastic, the rubber-like silicone made by Dow Corning.

The solubility of silicone products

Table I—Effect of Anhydrous Ethyl Alcohol on DC Silicone Resins

	DC 802	DC 993	DC 996
Alcohol at Room Temp.			
Cured 16 hr. at	250 deg. C	250 deg. C	150 deg.C
Weight increase, percent	3.04	2.54	3.16
Rating	Good	Good	Good
Alcohol at Reflux			
Weight increase, percent	11.10[1]	2.54[2]	3.16[3]
Rating	Fair	Fair	Fair

[1]Cracked easily. [2]Solution colored slightly. [3]Solution colored.

Table II—Resistance of Silastic to Methyl and Ethyl Alcohols at Room Temperatures

		After Immersion for 7 Days			After Reconditioning			
Type	Alcohol	% Change In Size	% Change In Weight	% of Shore Efficiency Retained	% Change In Size	% Change In Weight	% of Shore Efficiency Retained	Rating[1]
120	methyl	0	+1.82	71	0	−0.33	97	Good
120	ethyl	0	+1.77	77	0	−0.42	94	Good
125	methyl	0	+0.97	74	0	−0.32	90	Good
125	ethyl	+5.9	+1.59	70	0	−0.21	88	Good
150	methyl	+12	+9.07	87	0	−0.35	104	Good
150	ethyl	0	+2.41	91	0	−0.36	112	Good
160	methyl	0	+0.73	89	0	−0.30	108	Good
160	ethyl	+6.2	+0.78	85	0	−0.28	106	Good
161	methyl	0	+1.25	84	0	−0.66	96	Good
161	ethyl	0	+0.95	82	0	−0.27	96	Good
167	methyl	0	+0.82	87	0	−0.07	103	Good
167	ethyl	+5.5	+0.80	87	0	−0.16	101	Good
180	methyl	0	+1.19	85	0	−0.27	100	Good
180	ethyl	0	+1.4	81	0	−0.23	98	Good
181	methyl	0	+1.13	94	0	−0.15	107	Good
181	ethyl	0	+1.28	84	0	−0.16	99	Good

[1]Rating is based on changes in weight and volume, changes in durometer, observation of the physical condition of the test sample, and on the effects of reconditioning test samples for 10 days.

Match your Painting Problems against these SOLVED by Prufcoat*

Corrosion Case History #325

Sulfuric Acid Concentration Plant, troubled with costly corrosion, applied Prufcoat protective coatings and reports: *"Prufcoat on floors and pump supports — good after two years of service."*

Corrosion Case History #326

Muriatic Acid Fumes were eating concrete in a well-known acid plant. After repeated failures, Prufcoat was tried. 6 years later their job report reads: "Painted concrete piers and beams that were subjected to muriatic acid fumes with Prufcoat and to date have *noticed no further deterioration of the concrete."*

Corrosion Case History #327

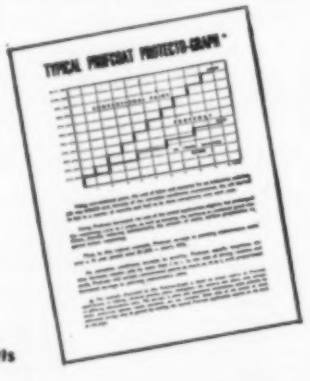
Plating Room Fumes are death to ordinary coatings. So this large plating plant tried Prufcoat on various surfaces subject to corrosion. Their report: "Only coating found to withstand action of hot plate solutions and *remain in good condition for two years."*

Corrosion Case History #328

50% Caustic Soda Solutions are carried in tank cars owned by this large plant. After repeated coating failures, Prufcoat was applied. Result: "Prufcoat . . . *unaffected by spills and drips after two years continuous service."*

Yes, in plant after plant Prufcoat is solving tough maintenance painting jobs involving corrosion from acids, alkalies, oil and water. Try this performance-proved protective coating yourself. Apply Prufcoat on machinery, equipment, pipes, walls, floors — *any metal, masonry or wood surface.* See how it *stops corrosion cold, saves your equipment, cuts painting maintenance costs.*

**Taken from actual reports on file at Prufcoat Laboratories, Inc.*



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Yes, the Protecto-Graph plan proves—*with your own figures* — that you can cut costly corrosion, save painting maintenance costs in your plant. Write for your copy *today.*

PRUFCOAT LABORATORIES, INC.
63 Main Street • Cambridge 42, Massachusetts

Seven attractive colors that apply like paint to metal, masonry or wood

SAVES MORE BECAUSE IT PROTECTS MORE

Table III—Resistance of Silastic to Ethyl Alcohol at Reflux

Silastic type	% change in weight	% change in volume	Rating
125	8.18	14.95	Fair
160	3.62	9.40	Good
180	5.08	14.62	Fair

in polar organic solvents varies with the amount of water in the solvent, the temperature and the solvent itself. A small amount of water in the organic solvent materially inhibits solvent action. Heat increases the solubility of silicones in polar organic solvents. In general, miscibility increases as the molecular weight of the alcohol increases. Silicone greases are similar to the fluids with respect to solvent resistance.

Table I shows the effect of ethyl alcohol on some typical silicone resins. Inspection of the test specimens indicated a negligible effect at room temperatures but some solvent action at higher temperatures.

Silastic, as shown in Tables II and III has good resistance to ethyl alcohol, particularly at room temperature. Some swelling is noted at higher temperatures but after drying, the Silastic samples regain their original shape and properties.

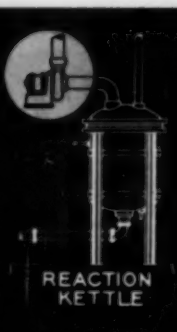
CARBON and GRAPHITE

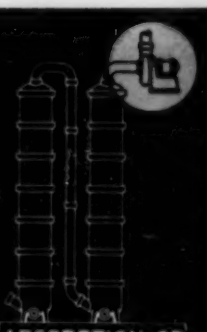
J. F. REVILOCK
National Carbon Co.
Cleveland, Ohio

CARBON, graphite and Karbate impervious carbon and graphite materials have been proved satisfactory and chemically resistant by laboratory tests and commercial applications to all concentrations of ethyl alcohol at all temperatures generally known to exist in industrial processes involving the alcohol. Carbon and graphite are not limited by temperature providing oxidants are not present at the specific temperatures involved. Karbate materials are limited to processing temperatures up to 340 deg. F.; however, the material may be used in higher temperature applications when means to keep the body of the material below 340 deg. F. are provided.

These materials are also being used successfully in commercial installations involving methyl, isopropyl and butyl alcohols; laboratory tests have demonstrated that carbon, graphite and Karbate are chemically resistant to amyl, octyl ,and other aliphatic alcohols. In some services, the alcohols, particularly ethyl alcohol, are in combination with chlorinated hydrocarbons, chlorine, sulphuric acid, hydrochloric acid and caustic which results in corrosive conditions much more severe than the alcohols alone. Mechanical corrosion due to aeration or high fluid velocities has had no effect on carbon, graphite

THESE FANS...

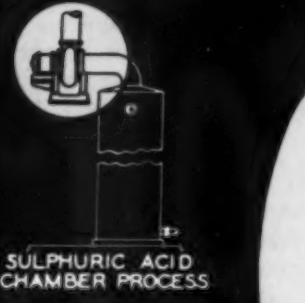


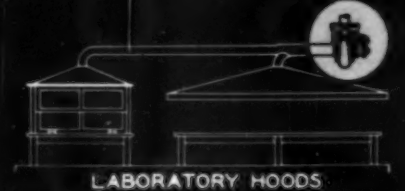


EVACUATE CORROSIVE FUMES

with practically

ZERO MAINTENANCE





Durco exhaust fans operate with a lasting efficiency that cannot be impaired by destructive fumes, vapors or gases.

Here's the reason: The vital parts of the fans—the parts in contact with the fumes—are made of Duriron, Durichlor or Durimet. These Durco alloys are uniformly *corrosion-resistant* throughout; require no coating or painting for protection.

DURIRON, of which standard Durco fans are made, is a high-silicon iron alloy containing approximately 14.5% silicon. It is highly resistant to the corrosive attack of all commonly used acids except hydrofluoric, sulfurous and oleum.

DURICHLOR is a high-silicon alloy, similar to Duriron, developed by Durco for resisting the corrosive action of hydrochloric acid below boiling point. It is similar to Duriron in resistance to other corrosives except that is superior for chloride solutions and chlorine gas.

DURIMET is a patented low carbon stainless steel containing nickel, chromium, molybdenum and copper. Durimet fans will safely handle the fumes of oleum, sulfurous acid, sulfur dioxide and hydrofluoric acid.

In addition to their extraordinary corrosion-resisting ability, Durco fans have many features of construction which permit:

- Easy access to all parts.
- Complete drainage of corrosive condensate.
- Removal of motor without disturbing fan connections.
- Rotation of volute to change direction of discharge.
- Minimum of maintenance. Most of the operation attention is confined to oiling the motor.

New Fan Bulletin No. 1102 gives complete information and engineering data. Write for your free copy.

DURCO Adv. 22-GM

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THE DURIRON COMPANY, Inc.
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"We installed a Henszey Feedwater Regulator in our Saratoga plant. It is a pleasure to mention that this has served us very satisfactorily. We have three boilers in our North Tonowanda plant for which we wish to consider the application of Henszey Boiler Feed Regulators."

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The complimentary comments of this leading eastern textile manufacturer concerning the Henszey Boiler Feed Regulator concurs with the opinions often expressed by other aggressive manufacturers.

The Henszey Boiler Feed Regulator works on the metallic expansion principle — no small tubes to spring leaks — nothing to rust — nothing to get out of order. When the boiler needs water, the Henszey Regulator automatically springs into action — delivers just the right amount of water to bring the level back where it belongs. Provides positive boiler water level control continuously and accurately under all load conditions.

HENSZEY CO., Dept. E10, WATERTOWN, WIS.

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or Karbate equipment in the industrial applications involving the above mentioned alcohols.

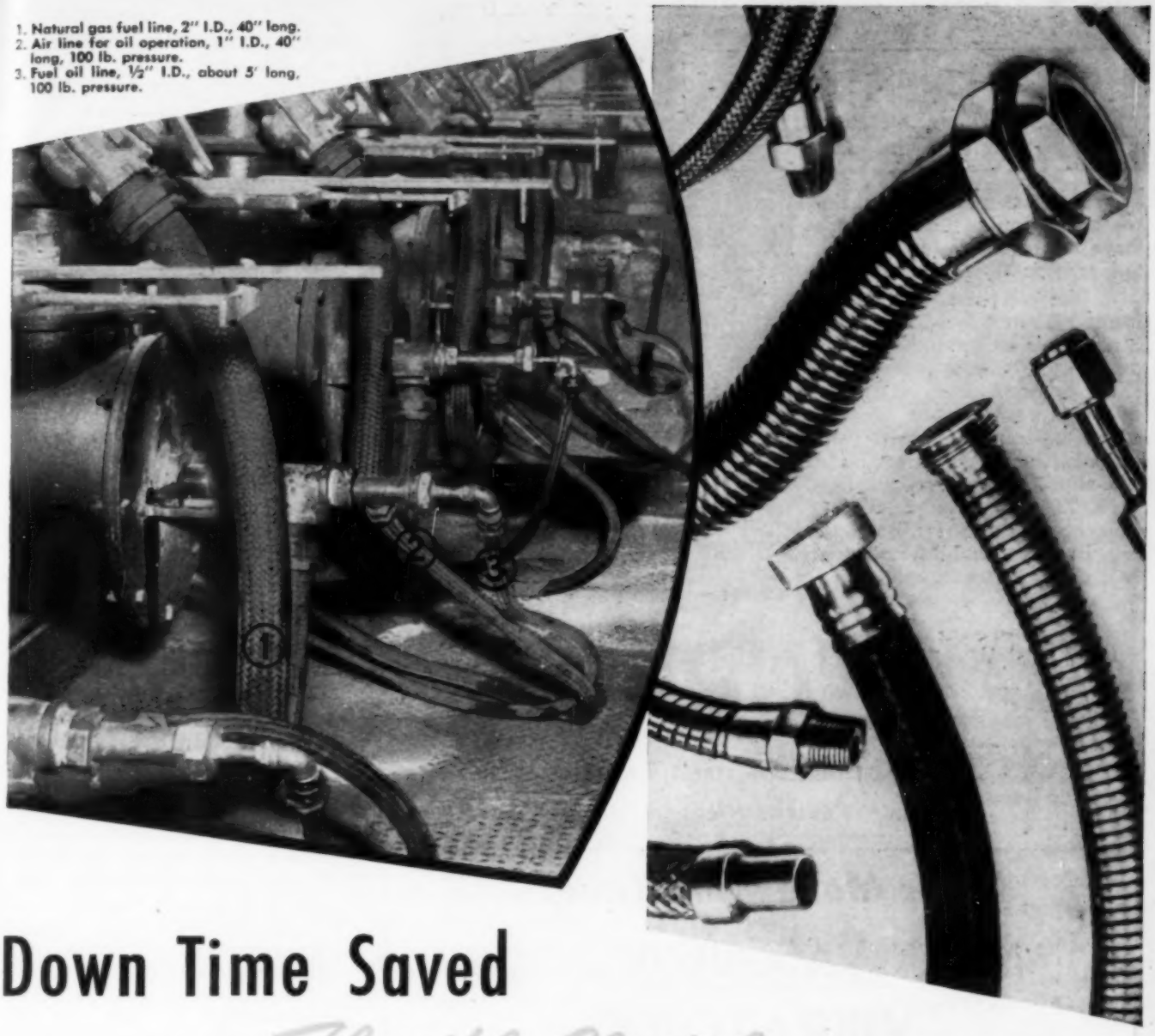
The largest use of Karbate equipment in connection with alcohol has been in alcohol chlorination processes, and extensive tests both in the laboratory and in the field have established the excellent service life of Karbate material in these processes.

Karbate bubble cap trays, up to 5½ ft. dia., complete with Karbate caps, chimneys and downcomers, have been in use for several years in the stripping and scrubbing phases of the concentrated sulphuric acid process for the production of ethyl alcohol from ethylene. In the stripping column, the Karbate trays are in contact with ethyl alcohol, ether, both in the liquid and vapor phases, and approximately 50 percent sulphuric acid at temperatures varying from 150 deg. F. to 230 deg. F. The Karbate trays in the scrubbing tower are in contact with dilute caustic (1-10 percent) and crude alcohol vapor at a temperature of 212 deg. F. Also in the caustic scrubber, the lining is fabricated from graphite slabs. Other Karbate bubble cap trays are operating satisfactorily in the stripping tower of a process similar to that mentioned above, for the production of tertiary butyl alcohol.

Because of its excellent heat transfer properties, Karbate impervious graphite is fabricated into a variety of heat exchanging equipment for use in processes involving the alcohols mentioned above or their derivatives, particularly the chlorinated derivatives. The types of exchangers used most frequently are: the shell aud tube type, the cascade type, the concentric type with steel or impervious graphite outer jacket, and the bayonet type. Several thousand square feet of Karbate tube bundle condensers are in service as reflux condensers on alcohol chlorinating reactors and as total condensers for chloral in the production of DDT. The construction and operation of these condensers are quite varied to suit the particular modification of the chloral production process developed by the various DDT manufacturers.

In the stripping phase of the ethylene to ethyl alcohol process, Karbate tube bundle exchangers are being used in calandria type boilers for the evaporation of the alcohol and ether from the water solution of sulphuric acid. The shell side is rated for 50 psi. steam. The other types of Karbate exchangers are being operated as condensers, heaters, and coolers, in a variety of applications involving butanol, isopropanol and higher molecular weight alcohols.

Karbate pipe and pipe fittings, globe valves, and centrifugal pumps are used in the conveying systems of various



1. Natural gas fuel line, 2" I.D., 40" long.
2. Air line for oil operation, 1" I.D., 40" long, 100 lb. pressure.
3. Fuel oil line, ½" I.D., about 5' long, 100 lb. pressure.

Down Time Saved

. . . WITH Flexible Metal CONNECTORS

Here's a bank of continuous billet heating furnaces, fueled by natural gas, and fitted with oil burners for standby service. Each furnace, therefore, needs three connections for its fuel supply: natural gas, oil, and an air line for oil operation. This presented a problem to the steel mill. If rigid piping were used, the need for frequent cleaning and adjusting of each burner would mean considerable loss of time in dismantling and assembling. The solution was American Seamless Flexible Metal Tubing in three different sizes, fitted with heatproof, re-attachable couplings.

American Seamless is usually made in bronze, but is also available in stainless steel and other metals; it is flexible tubing in one piece—no joints or welds. Several types of interlocked, strip-wound flexible hose in copper, copper alloys, nickel alloys, aluminum and steel complete the basic "American" line.

We believe industry has literally millions of opportunities for advantageous use of flexible metal connectors. Shown above are a few of thousands of special assemblies which "American" has designed for specific jobs. Send us your problem and we'll go to work on it. There's no charge for our engineering service.

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industrial processes using ethyl alcohol and its derivatives. A particularly interesting application is the use of a Karbate centrifugal pump as a mixer reactor for the production of chloral. In this application the chlorine is injected into the alcohol stream just prior to the suction of the pump and consequently a thorough dispersion of the chlorine throughout the alcohol is obtained by the turbulent action inside of the pump.

Porous carbon diffusers or perforated Karbate pipe diffusers are being used successfully in connection with alcohol chlorinating processes. Other porous carbon diffusers have found use in stripping butyl alcohol from heavier organic liquids by bubbling air through the mixture.

ALUMINUM

J. P. BALASH and E. D. VERINK, Jr.
Aluminum Company of America
New Kensington, Pa.

ALUMINUM alloys are eminently suited for service with most of the commercial alcohols. Chemical equipment and shipping containers made of aluminum are extensively employed for industrial and beverage alcohols. Available information indicates that at room temperature, commercial alcohols, such as methyl, ethyl, propyl, butyl, etc., are substantially without effect on aluminum. At elevated temperatures, aluminum is normally suitable provided a trace of moisture is present. Even those alcohols which contain heavy metals or other contaminants generally can be successfully handled in aluminum by the addition of an inhibitor, such as sodium chromate. Aluminum stills, heat exchangers, piping, tankage, and shipping containers have given long service with a variety of alcohols and products employing alcohol in their manufacture.

In addition to corrosion resistance, ease of fabrication and erection, aluminum alloy storage tanks, piping, stills, filters, condensers, condenser tubing, and shipping containers often have special advantages for processing such materials. Aluminum is non-sparking and does not stimulate decomposition of organic liquids.

An all-aluminum reflux condenser built of 2S alloy has been in continuous service for over 16 years condensing a 90 percent methyl alcohol, 10 percent formaldehyde mixture at temperatures around 50 deg. C.

Aluminum alloys may be employed for alcohols produced both by the grain fermentation process and petroleum gas synthesis. For fermentation processes, aluminum has the advantage that it is non-toxic to living organisms, which property has encour-

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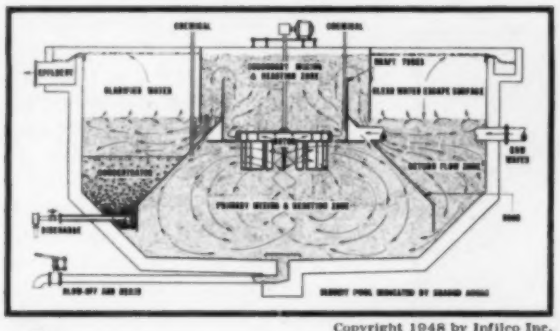

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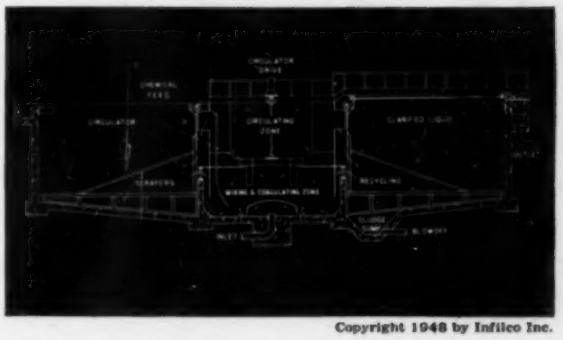

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—lower construction costs

2. MORE COMPLETE COAGULATION

—cleaner effluent
—greater chemical economy
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3. MORE UNIVERSAL IN APPLICATION

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ELIMINATE *costly Time Out...*

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Six outstanding advantages make it possible for the new Hills-McCanna "K" Type Pump to offer more accurate metering and proportioning with less maintenance and fewer costly shut downs:

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aged the use of aluminum for the production of citric and gluconic acids, penicillin and other anti-biotics.

High purity products, such as perfumes containing alcohols, are normally handled and shipped in aluminum bottles or other containers. An aluminum still and pipe for handling 95 denatured alcohol have been in satisfactory use for over six years.

In the manufacture of plastics where clarity and absence of discoloration are of paramount importance, isopropyl alcohol is handled and stored in tanks of aluminum alloy 3S.

Aluminum alloys have found use in the alcoholic beverage industry where purity of product and ease of maintenance are important. For example, an aluminum gin still, piping, condenser, and condenser tubing have given satisfactory service for more than 14 years handling 155-165 proof material. Practically all types of brewery equipment, brew kettles, starters, fermenters, storage tanks, and government tanks have been used in the United States since 1934. In addition, over 1,000,000 aluminum beer barrels are currently in service.

Aluminum alloys have long been considered a standard material of construction for tanks and tank cars handling glycerine produced from vegetable oils and fats. More recently, 36 aluminum tank cars were purchased for synthetic glycerine. Aluminum alloys protect the water white quality of this higher alcohol.

LEAD

KEMPTON H. ROLL
Lead Industries Assn.
New York, N. Y.

From the engineering materials viewpoint, lead is not attacked by alcohol. However because alcohol is not considered in the category of corrosive chemicals, it generally has no occasion in the course of its manufacture to encounter lead directly.

In the manufacture of those alcohols destined for human consumption, the use of lead in contact with the alcohol is not recommended.

IRON AND STEEL

A. W. SPITZ
American Cyanamid Co.
New York, N. Y.

Cast iron and steel are extensively used for tanks, pumps, and pipelines handling methyl, ethyl, butyl, amyl alcohol, glycerine and glycols. Satisfactory equipment life can usually be expected. However, alcohol and water solutions, in the presence of air, may cause excessive corrosion, as may the presence of small amounts of organic acids. In some instances,

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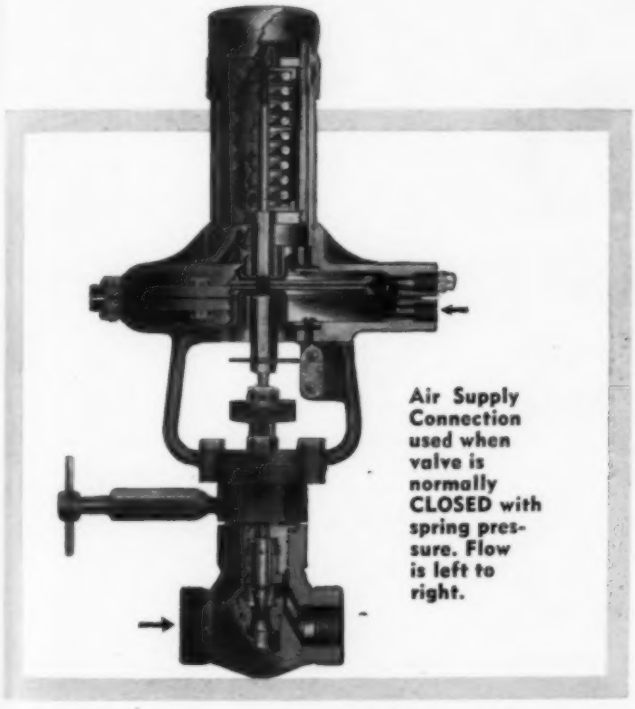
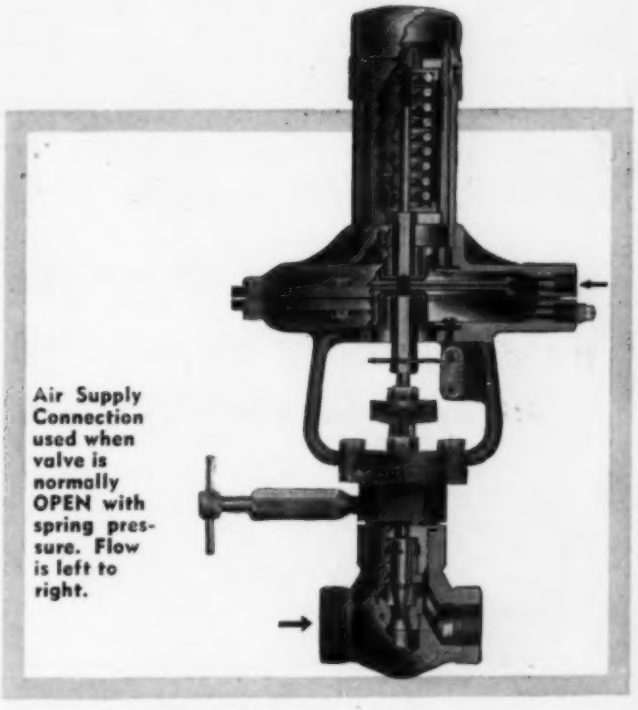
climax TYPE 1515 DIAPHRAGM CONTROL VALVE



Air Supply Connection used when valve is normally CLOSED with spring pressure. Flow is left to right.



Air Supply Connection used when valve is normally OPEN with spring pressure. Flow is left to right.

Here's another CLIMAX first . . . developed to meet the needs of pilot plants, research laboratories and other installations. A small, compact valve designed to handle relatively small flows. Yet it is capable of performing usual motor valve duties, within its capacity. And it can be adjusted from a normally open to a normally closed valve in a few minutes, WITHOUT DISMANTLING!
Screwed bonnet construction. Cooling fins for temperatures in excess of 450° F. Full selection of sizes for pipe up to 1 inch. Write for full description, latest specifications, performance records.

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CUSTOM-BUILT FOR *Your* JOB!

UNIFORM particle dispersion and thorough blending of dry material, powder or granule, before or after pulverizing

RAPID, smooth, vibration-free operation. (Totally enclosed worm gear drive.)

ECONOMICAL, very low power consumption.

CLEAN . . . conical shaped blender permits 100% emptying, without dust, and with minimum chances of contamination. Easy to clean. No baffles.

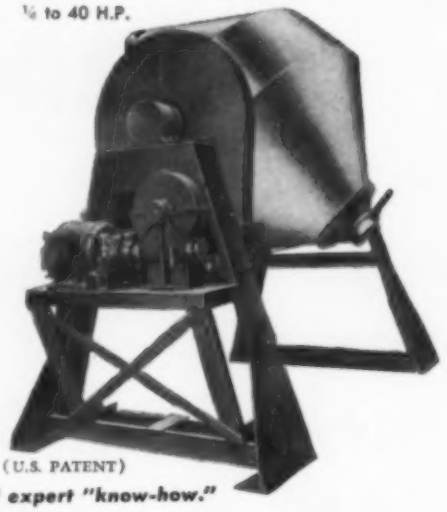
SIMPLE . . . one-man operation.

SAFE . . . minimum "occupational hazards for workers."

SELF-CONTAINED, precision-built, assembled and inspected carefully in our own plant. (Motor is built into unit.)

CAPACITY . . . blends batches up to 25,000 lbs.

¼ to 40 H.P.



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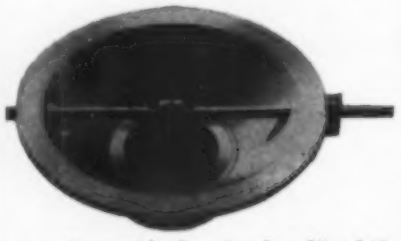

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For maintaining particle size. For dispersion of material which tends to ball or lump (breaks material while blending). Adaptation for rubbing out material (while blending). Jacketing to keep batches at required temperature. Provision for penetrating shell for injection of gas or liquid (while blending), or for vacuum processing.

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slight contamination and discoloration may occur; high purity glycerine, for example, is usually stored in more resistant materials when color is important.

COATINGS*

THE FOLLOWING plastics that are used as a basis for protective coatings are resistant to ethyl alcohol: Phenol formaldehyde, polyvinylidine chloride, chlorinated rubber, polyvinyl chloride-acetate copolymer, cellulose acetate, polystyrene, urea formaldehyde, and melamine formaldehyde.

The actual formulation of paints from these plastics has a bearing on their resistance to alcohol as it has with other reagents. The baked coatings are, in general, superior to the air dried material.

Spot tests conducted for 24 hr. on proprietary air-dried coatings in a mixture of 95 percent ethanol and 5 percent methanol at room temperature gave the following results (on the basis of 10 being "no visible effect after 24 hr. exposure"):

Primers		
Sovaklor 28J310	Socony	10
CE9808	Sherwin-Williams	10
NuType	Gregg	9
Miracle	Debevoise	9
Amercoat 44	American Pipe	9
Amercoat 55	American Pipe	9
RustOleum	RustOleum	8
Rubber Base	Mercury	7
Chromate	Areo	4
Submarine	DuPont	9
Water Proof	Areo	10
Silica Graphite	Dixon	7
Kromik	Sherwin-Williams	6
Sublead	Mercury	6
General Finishes		
Sovaklor 28J302	Socony	10
Amercoat 33	American Pipe	9
Amercoat 44	American Pipe	9
NuType	Gregg	8
CE9809	Sherwin-Williams	10
CRA-1132	Monsanto	8
Amercoat 55	American Pipe	7
Silica Graphite	Dixon	7
Tremflux	Tremco	7
Sublead	Mercury	4
Koralon Black	Tycor	10
RustOleum	RustOleum	9
Prufcoat	Prufcoat	9½
Koralon Red	Tycor	9
Corrosite	Corrosite	9
Tremgard	Tremco	7
Rubber Base	Mercury	6
Amercoat 88	American Pipe	8

Following is the text of a special communication to the author from Fred L. Sharpe, Jr., sales engineer for the General Coating Co. of Woodbridge, N. J.

"Two types of protective coatings can be recommended to withstand the solvent action of alcohols; namely, the thermosetting (baked) phenolic coating and the airdry vinyl resin coating. They compare as follows:

"(1) As stated, both baked phenolic coatings and air-dry vinyl resin coatings have good resistance to alcohols. Comparing these two types of coatings, it can be generally stated that

* The author of this article is with a large chemical company which uses, but does not produce, protective coatings.

PLASTICIZERS? **oxidizing agents?**

ALKYLATING AGENTS?

curing accelerators? **germicides?**

Use these Wyandotte Benzenesulfonic Acid Derivatives

Products Available	*Suggested Uses*
Benzenesulfonchloride★	As an intermediate in the preparation of dyestuffs, pharmaceuticals and resins. For blocking active hydroxyl and amino groups in organic compounds.
Benzenesulfonamide★	As a plasticizer for polyamide resins. As an intermediate in the manufacture of germicides, oxidizing agents, pharmaceuticals and dyestuffs.
N-substituted Benzenesulfonamides:	
N-Ethyl Benzenesulfonamide N,N-Diethyl Benzenesulfonamide N-Isopropyl Benzenesulfonamide N-n-Butyl Benzenesulfonamide N,N-di-n-Butyl Benzenesulfonamide	Plasticizers for cellulose-derived plastics, synthetic rubber and polyamide resins.
Benzenesulfonic Acid Esters:	
Methyl Benzenesulfonate Ethyl Benzenesulfonate n-Propyl Benzenesulfonate	Alkylating agents.
n-Butyl Benzenesulfonate Ethylene Glycol Dibenzenesulfonate Diethylene Glycol Dibenzenesulfonate	As curing accelerators for various synthetic resins. Also as plasticizers and softeners for cellulose-derived plastics.
Chloramine-B Dichloramine-B	Germicidal and deodorizing agents. Oxidizing agents. For controlling fungi in grain and seeds.

★*Available in both technical and refined grades.*

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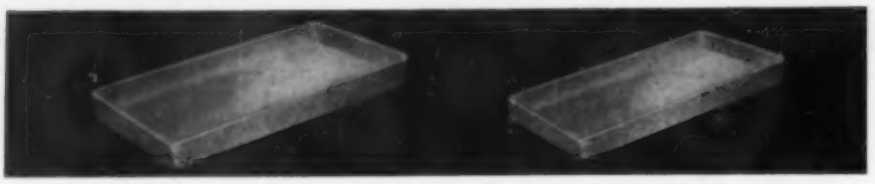
AMERSIL* SILICA TRAYS



—are suitable for repeated applications involving temperatures up to 1000°C. These trays are chemically inert—will not contaminate material treated—will withstand extreme thermal shock. For applications demanding temperatures over 1000°C., Amersil Trays may be used for short periods.

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the baked phenolic coating offers better solvent resistance due to its inherent properties established during the baking or polymerization of the phenolic resin.

"(2) The baked phenolic coating yields a much harder surface which results in better abrasion and erosion resistance.

"(3) Regarding temperature resistance, vinyl coatings should only be used at room temperature when exposed to alcohol solutions whereas baked phenolic coatings can withstand much higher solution temperatures. Regarding alcohol fumes, vinyl coatings can withstand concentrated fumes at a maximum operating temperature of 60 deg. C. Baked phenolics can withstand concentrated alcohol fumes at a maximum operating temperature up to 200 deg. C.

"(4) Due to better corrosion and temperature-resistant properties, the baked phenolic coating can be used in a much greater range of chemical solutions containing alcohol.

"(5) Regarding application, the air-dry vinyl coating has the advantage in that it does not require baking. The baked phenolic coatings require baking temperatures of approximately 400 to 450 deg. F. in order to obtain complete polymerization. Thorough surface preparation such as sand-blasting is generally recommended for both the vinyl and phenolic coatings in order to obtain proper adhesion.

"When considering the use of a protective coating in an application involving the use of alcohol, the operating conditions to which the coating shall be subjected should be carefully analyzed in relation to the above noted properties of the coating. If practical, a sample panel coated with the recommended coating should be exposed to the actual operating conditions."

NICKEL, NICKEL ALLOYS

W. Z. FRIEND
International Nickel Co.
New York, N. Y.

NICKEL, Monel and Inconel usually are highly resistant to all of the alcohols including the higher alcohols, even at elevated temperatures. The Ni-Resist alloys, with the exception of the stainless variety, Type 5, may be subject to superficial rusting in water solutions of the alcohols, but actual corrosion rate of all of these alloys usually is very low. Many of the applications of nickel, Monel and Inconel in connection with alcohols are in the preparation and handling of alcoholic mixtures such as drugs, perfumes, hospital solutions or alcoholic beverages where it is desired to keep metallic contamination at a minimum. Other applications are in the reactions of

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SPROUT WALDRON
Manufacturing Engineers
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alcohols with other chemicals, as in esterfications where the active corrosive may be an acid such as acetic or sulphuric. Monel, in particular, is used in esterifications for such equipment as reactors, heating coils, piping, and agitators as described previously in this magazine (Dec. 1946, p. 218). Other applications include distilling and condensing equipment in the recovery of alcohols by distillation from or with other solvents such as acetates and acetone in solvent recovery processes. The results of a number of corrosion tests in miscellaneous solutions where alcohols are present in major proportions, are given in Table I.

Monel and nickel are used to a considerable extent in the production of glycerine in soap and fatty acid plants. Nickel and nickel-clad steel find particular use for glycerine stills, evaporating coils, condensers and for pipelines handling the finished product. The results of a number of plant corrosion tests in the distillation, finishing and storage of glycerine are given in Table II.

Table I—Corrosion Tests in Mixtures Containing Alcohols

	Corrosion Rate, Mils Per Year			
	Monel	Nickel	Inconel	Ni-Resist (Type 1)]
Test 1a	0.0	0.0	.....	...
Test 1b	0.0	0.0	.....	...
Test 2	0.7	1.0	<0.1	3.0
Test 3	0.3	0.4	0.2	4.0
Test 4	0.1	...	.....	...
Test 5	<0.1	<0.1	<0.1	8.0
Test 6	0.4	0.6	<0.1	3.0
Test 7	0.1	0.1	<0.1	...
Test 8	0.7	0.9	10.0	...
Test 9	0.2	...	.....	...
Test 10	0.6	3.0	<0.1	...
Test 11	0.2	...	.....	...

< Less than.

Test 1: Laboratory corrosion test in C.P. methanol. (a) Immersed in liquid at room temperature for 6 months. (b) In vapor of boiling liquid for 1 month.

Test 2: Plant corrosion test distillation column during distillation of blow gas mixture in pulp mill for recovery of methanol. Water solution contains 15 to 95 percent methanol, plus small amounts of hydrogen sulphide, mercaptans, ammonia and air. Temperature 60-212 deg. F. Duration of test 762 days.

Test 3: Plant corrosion test in lower section of distilling column during distillation of crude methanol. Temperature 160 deg. F. max. Duration of test 80 days.

Test 4: Laboratory corrosion test in water solution containing 70 percent by volume of ethanol. Temperature 104 deg. F. Duration of test 8 hr.

Test 5: Plant corrosion test immersed in storage of solvent mixture containing 23-25 percent ethanol, 5-8 percent acetone, 1-2 percent ethyl

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Whatever the conditions: Extreme temperatures . . . . extreme pressures . . . . steady flow or shock service . . . . corrosion resistance . . . product purity.

Whatever the material: Forged carbon steel . . . wrought iron . . . . carbon or chrome moly . . . . Stainless 304, 347, 316 . . . . Monel . . . . Nickel . . . . Inconel . . . . Aluminum . . . . other usual industrial materials.

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acetate, balance water. Temperature 40-70 deg. F. Duration of test 225 days.

Test 6: Plant corrosion test in vapor space at top of carbon adsorber during adsorption and steaming of solvent vapor mixture containing 68 percent ethanol, 30 percent acetone, 2 percent methanol, balance air. Average temperatures: 70 deg. F. during adsorption, 260 deg. F. during steaming. Duration of test 12 days.

Test 7: Plant corrosion test in distillation column during distillation of solvent mixture, containing 42 percent ethanol, 25 percent ethyl acetate, 20 percent butyraldehyde, 3 percent benzene, balance water. Temperature 158-170 deg. F. Duration of test 215 days.

Test 8: Plant corrosion test in distillation column during distillation of mixture containing 42 percent ethanol, 2.3 percent ethyl acetate, 1.5 percent acetic acid, 1.4 percent sulphuric acid, balance water. Temperature 170-212 deg. F. Duration of test 181 days.

Test 9: Laboratory corrosion test in solution of 30 percent by wt. isopropanol in water. Temperature, room. Duration of test 5 days.

Test 10: Plant corrosion test in spent solvent isopropyl alcohol (100-120 proof), plus 3 percent sugar solids and trace of HCl (pH 3.5). Temperature 90-120 deg. F. Duration of test 37 days.

Test 11: Laboratory corrosion test in uninhibited ethylene glycol. Temperature 265 deg. F. Duration of test 120 hr.

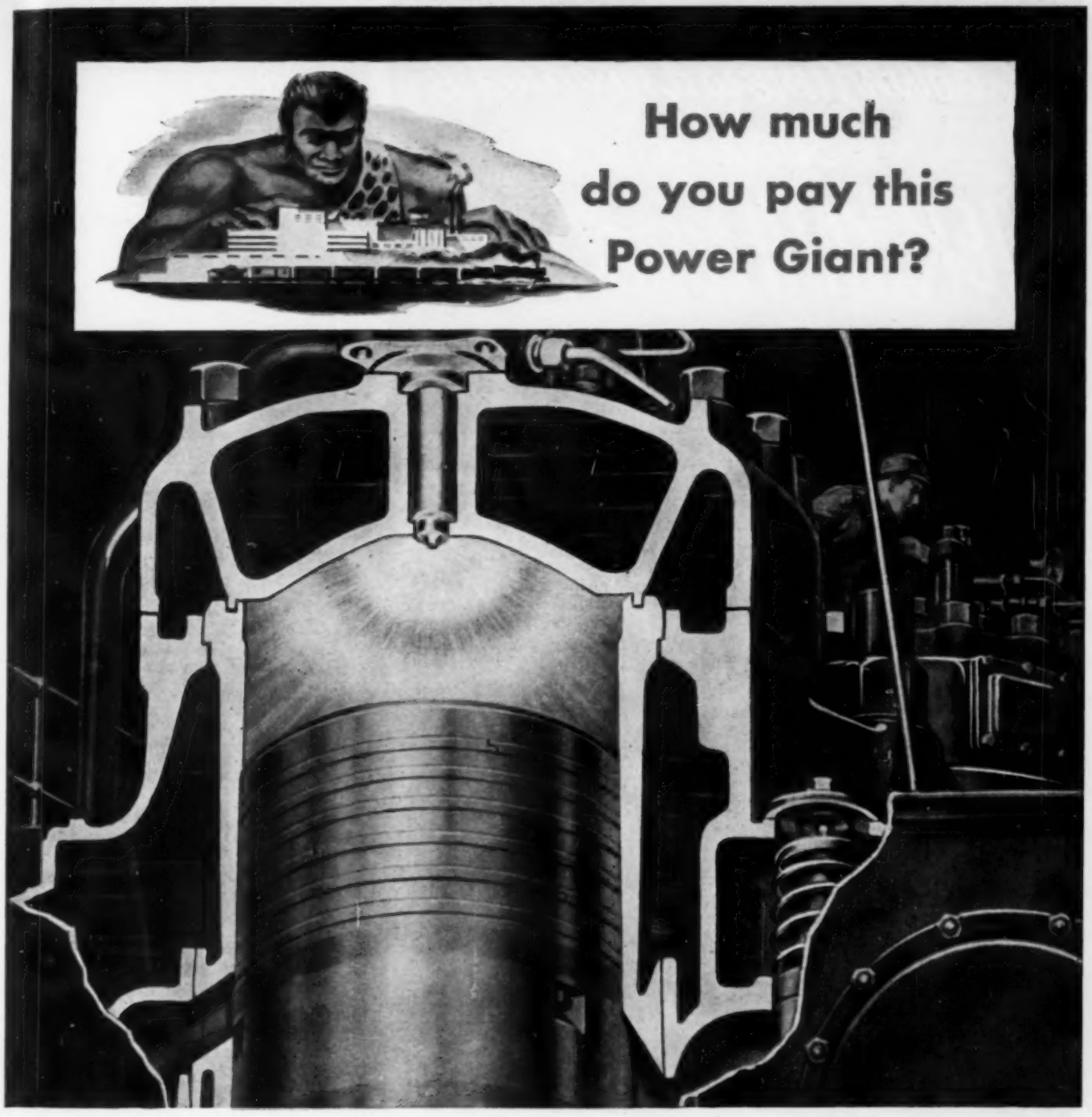
Table II—Plant Corrosion Tests in Distillation, Finishing and Storage of Glycerine

	Corrosion Rate, Mils Per Year			
	Monel	Nickel	Inconel	Type 1, Ni-Resist
Test 1a	1.3	1.2	0.5	5.0
Test 1b	0.7	0.6	0.4	6.0
Test 2	<0.1	<0.1	<0.1	....
Test 3a	1.4	0.9	<0.1	13.0
Test 3b	1.6	1.6	<0.1	12.0
Test 4	<0.1	0.1	<0.1	....
Test 5a	<0.1	2.0	<0.1	....
Test 5b	0.1	1.6	0.1	....
Test 6	0.0	0.0	0.0	....
Test 7	0.0	0.0	0.0	....

< Less than.

Test 1: In crude glycerine evaporator under 25-29 in. Hg vacuum. Initial concentration 10 percent NaCl, 5 percent glycerine. Temperature 150-165 deg. F. Duration of test 33 days. Final concentration 8 percent NaCl, 80 percent glycerine. (1a) immersed in liquid at bottom of evaporator. (1b) In vapor at top of evaporator.

Test 2: Test spool immersed half-way down in scale tank in crude glycerine containing 81 percent glycerine,



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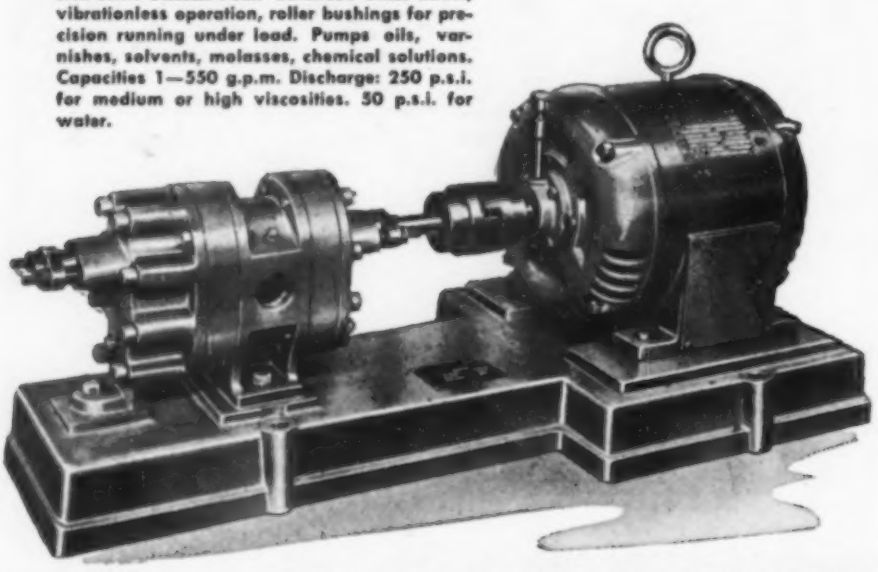
If down-time is a headache specify SIER-BATH GEAREX PUMPS

THE design and construction of Sier-Bath Gearex Pumps have been planned to insure continuous service and to avoid shut-downs. Manufacturing pumps of the utmost durability comes naturally to this Company, for Sier-Bath has been famous for many years as a manufacturer of precision gears. Gearex pumps are made under the same high standards that have been inherent in this shop in the making of fine, accurate gears.

Gearex Pumps are long-lived positive displacement units, discharging liquids without pulse or vibration. Double helical pumping rotors and discharge passages of proper area to insure continuous overlapping displacement of liquids are a feature of the Sier-Bath Gearex Pump. Since the rotors are not in contact, there is very little wear. The rotors are keyed to shafts and carefully timed through heat treated steel timing gears, keyed and locked on the ends of the shafts. These are only a few of the fine points of construction in these high quality pumps. Send for booklet.

SIER-BATH GEAREX PUMP Balanced axial thrust, vibrationless operation, roller bushings for precision running under load. Pumps oils, varnishes, solvents, molasses, chemical solutions. Capacities 1—550 g.p.m. Discharge: 250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.



For Higher Pressures and Capacities, Use SIER-BATH SCREW PUMPS

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 **MEMBER A. G. M. A.**

Sier-Bath GEAR and PUMP CO., Inc.

9259 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

8-10 percent NaCl and 7 percent water. Pumped in and out of tank continuously at approximate rate of 200 lb. per min. Temperature 70 to 280 deg. F. (average 240 deg. F.) Duration of test 31 days.

Test 3: In finished glycerine still operating under 10 in. Hg vacuum. Temperature 300 deg. F. (3a) Immersed in liquid. Duration of test 27 days. (3b) In vapor at top of still. Duration of test 88 days.

Test 4: Immersed half-way down in bleaching tank in 95 percent glycerine, 5 percent water plus bleaching carbon. pH 6-7. Mild air agitation. Temperature 100-250 deg. F. (average 140 deg. F.) Duration of test 33 days.

Test 5: In glycerine bleach tank during bleaching with carbon. Temperature, atmospheric. Duration of test 100 days. (5a) Fully immersed. (5b) Floating at liquid level.

Test 6: Immersed half-way down in storage tank in finished glycerine containing 95 percent glycerine and 5 percent water. pH 6-7. Temperature 100-170 deg. F. (average 130 deg. F.) Duration of test 32 days.

Test 7: Partially immersed at surface of finished glycerine in storage tank. Temperature, atmospheric. Duration of test 250 days.

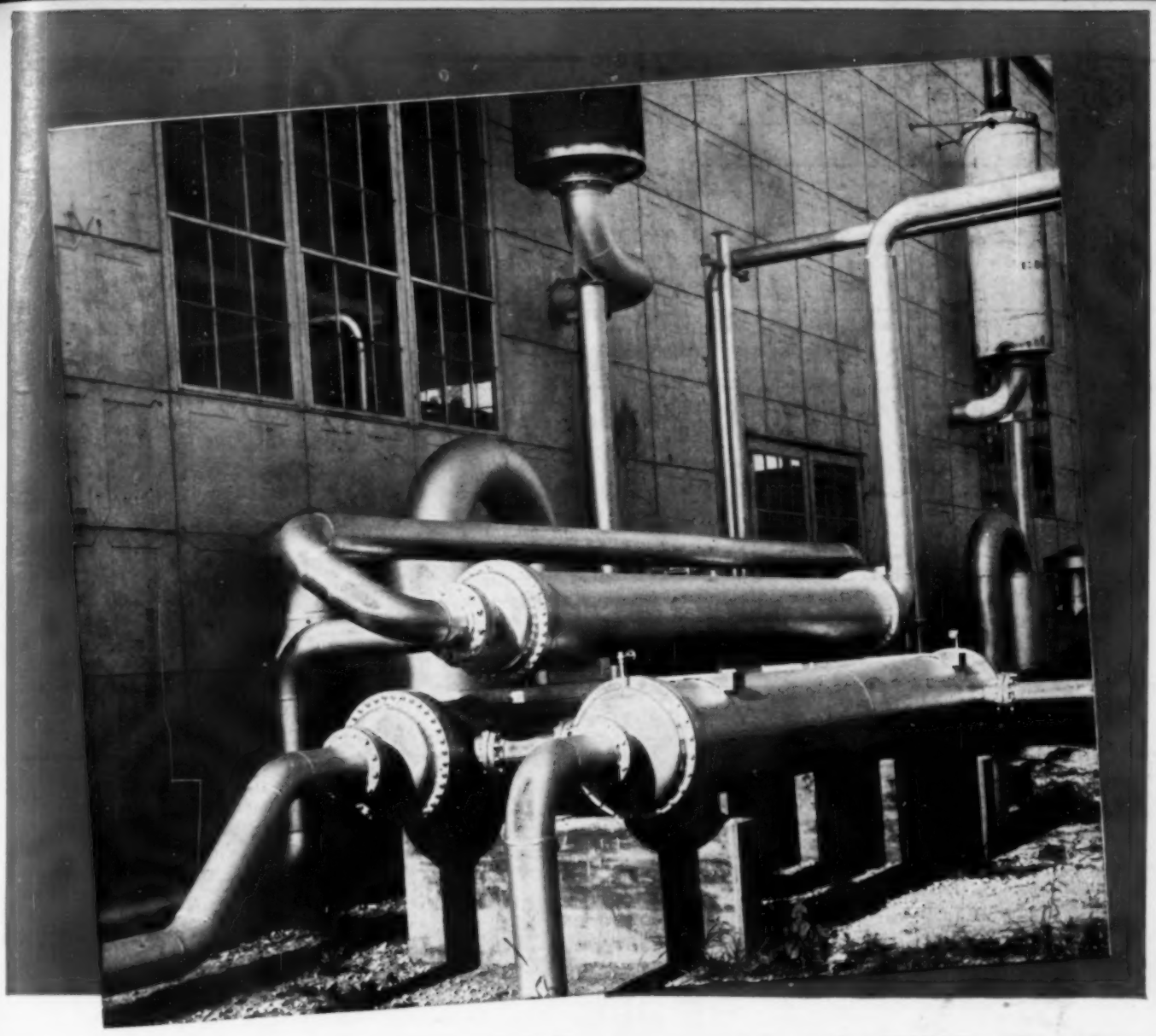
TANTALUM

LEONARD R. SCRIBNER
Fansteel Metallurgical Corp.
North Chicago, Ill.

SO FAR as it is known, tantalum is inert to all alcohols, esters, aldehydes and ketones at all concentrations and temperatures at which it has been tested or used. Other metals less valuable than tantalum appear to be sufficiently satisfactory, however, so that there are few, if any, applications where tantalum need be considered in corrosion problems where alcohol alone is involved.

When alcohol is mixed with acids, however, problems of corrosion or product contamination become more difficult, and sometimes the use of tantalum becomes necessary. One possible instance is where sulphuric acid is used to dehydrate alcohols, where tantalum heaters and condensers can be used in the distillation operations, also to concentrate the acid for re-use.

In food and pharmaceutical processes, there are numerous applications where contamination, taste or odor can be traced to attack on process equipment by alcohols mixed with acids. In practically all such instances, the use of tantalum at the correct trouble spot is an effective and permanent remedy.



Tube-Turn equipped piping on heat exchangers at Ohio Fuel Gas Company

Smoothie Pays off

NO doubt about it, the piping at Ohio Fuel Gas Company's Mt. Sterling compressor station is a smooth job.

In a plant handling peak loads of 75,000,000 cubic feet of natural gas per 24-hour day, involving the admixture of propane at 300 psi, the smoothness made possible by Tube-Turn welding fittings pays off—in piping efficiency, safety, long life, low maintenance cost.

With their full effective radius, smooth inner walls, and the absence of pockets between the joints, Tube-Turn welding fittings hold down pressure loss and erosion. They are as strong as the pipe, and permanently leakproof at the welded joints. They carry the No. I name in welding fittings, and are 100% dependable for dimensional accuracy and adherence to standards. They come in a wide range of types and sizes, metals and alloys. Your nearby Tube Turns distributor carries a large stock.

For good service in good connections, specify "Tube-Turn."

TUBE TURNS, INC.

238 E. Broadway, Dept. B, Louisville 1, Ky.

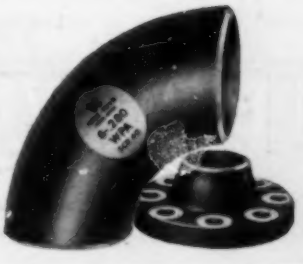
District Offices at New York, Philadelphia, Pittsburgh, Detroit, Chicago, Houston, Tulsa, San Francisco, Los Angeles

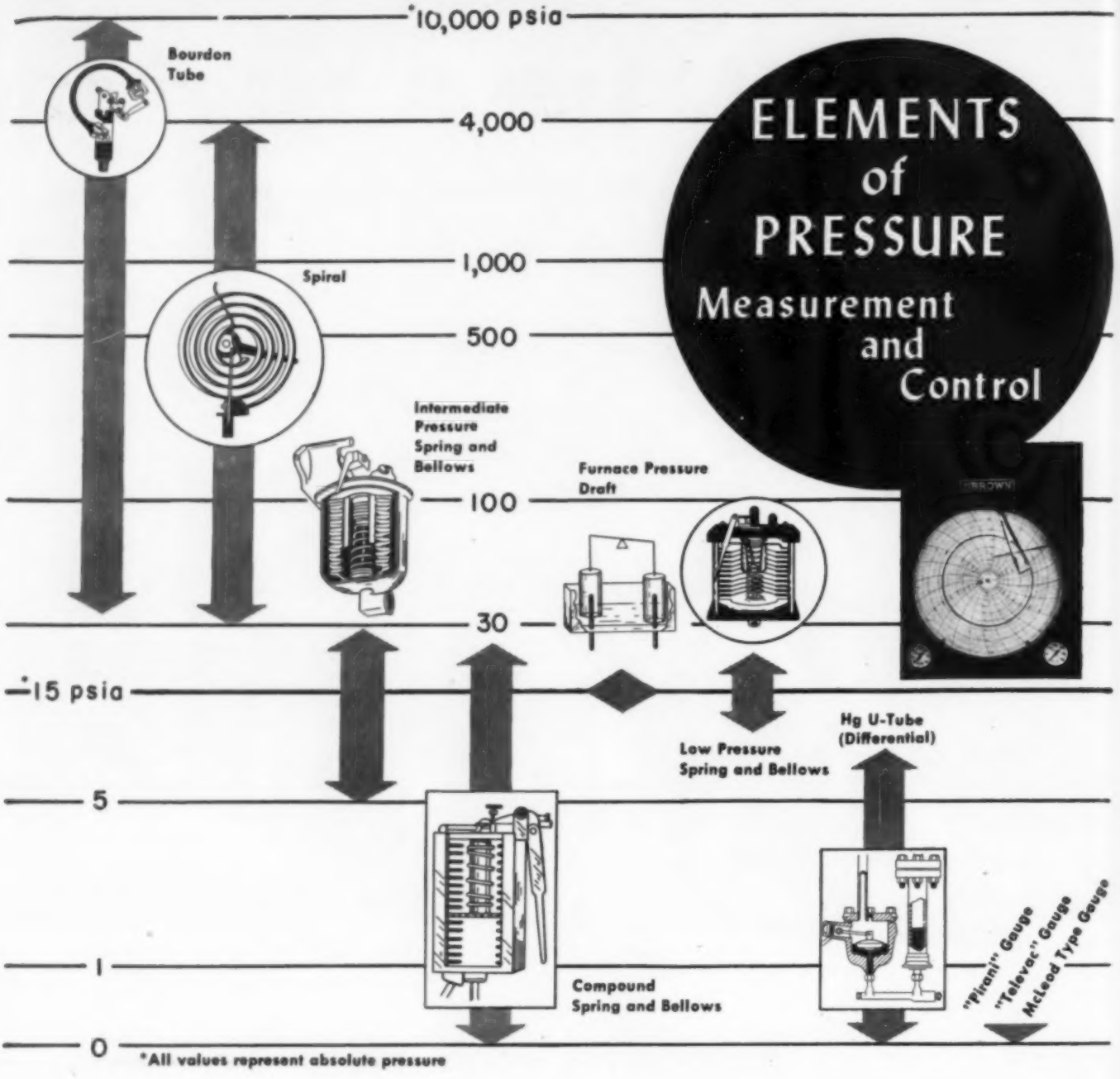
TUBE-TURN

tt

WELDING FITTINGS AND FLANGES

Write for the new and revised Tube Turns' chart of "Pipe and Fitting Materials". Covers ASTM and other specifications, chemistry, service temperature limits, welding data.





FROM tons to microns—never underestimate the importance of precise pressure control of your processes. The effect of slight pressure inaccuracies has proven to be more far-reaching than is commonly suspected.

Proper handling of pressure problems necessitates a full line of pressure elements—not just making one element do for a variety of applications. The complete line of pressure equipment, and broad knowledge of its application, available through The Brown Instrument Company is unsurpassed.

Accuracy and control quality are part of the story; minimum hysteresis effect and far greater over-load protection are additional factors that make Brown Pressure Gauges *the finest available to industry today.* An interesting catalog on pressure gauges is now available. Send for Catalog 7000.

THE BROWN INSTRUMENT CO., 4478 WAYNE AVE., PHILADELPHIA 44, PA.

DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

Offices in principal cities of the United States, Canada and throughout the world.

BROWN *Advanced Instrumentation* **FOR BETTER PROCESSING**

Product of MINNEAPOLIS **Honeywell**

NAMES IN THE NEWS

Man of the Month

E. Cox

Edwin Cox last month was elected a vice president of the Virginia-Carolina Chemical Corp.

Edwin "Pete" Cox, a native Richmonder born Sept. 20, 1902, received his B.S. degree in chemical engineering and master's degree in chemistry from Virginia Military Institute.

In 1920 he joined Virginia-Carolina as an analytical chemist and since has served in many capacities in the company's operations, including plant management, sales and research. Mr. Cox served in both World Wars. During World War II he served in the Mediterranean and European Theaters and, at the close of the war, was attached to the General Staff, SHAEF. Upon his discharge from the Army with the rank of colonel and return to civilian life, Mr. Cox resumed his connection with V-C as manager of the chemicals division.

He is a member of ACS, AAAS, AIC and the Virginia Academy of Science as well as AIChE.

Richard W. Porter, until last month an assistant editor of *Chemical Engineering,* has joined Fritz Publications in Chicago as editorial director of *The Paper Industry and Paper World.*

R. W. Porter

K. J. Brunings

Karl J. Brunings has resigned as associate professor in the chemistry department, Johns Hopkins University, to accept a position in the research department of Chas. Pfizer & Co., Inc., Brooklyn, N. Y.

John J. Freeman has been named technical director of the Neville Co. of Pittsburgh.

Reid T. Milner became director of the Northern Regional Research Laboratory of the Department of Agriculture on October 1. Dr. Milner has been a member of the staff of the Bureau of Agricultural and Industrial Chemistry for 18 years, first at the Urbana Soybean Laboratory and more recently at the Peoria Northern Regional Lab. Milner as director succeeds **G. E. Hilbert** who advanced to the position of chief of the Bureau recently.

Monroe M. Solomka has joined the staff of R. S. Aries & Associates. He was formerly a project engineer with the National Lead Co.

Robert U. Haslanger, newly appointed assistant to the general manager of the western division of Monsanto Chemical Co. has assumed his new duties in Seattle.

William A. Simanton is now technical director and assistant to the president of Agricultural Chemicals Co., Phoenix. Dr. Simanton was formerly with Shell Oil Co.

Hillary Robinette, Jr., has been named research director of Amalgamated Chemical Corp., Philadelphia, where he will head up an expanded consulting service for the textile industry. Mr. Robinette has been with Publicker Industries, Inc., Philadelphia, in the new products division since December 1945.

Carl F. Prutton, formerly head of the department of chemistry and chemical engineering at Case School of Applied Science, has joined Mathieson Chemical Corp. as director of research.

C. F. Prutton

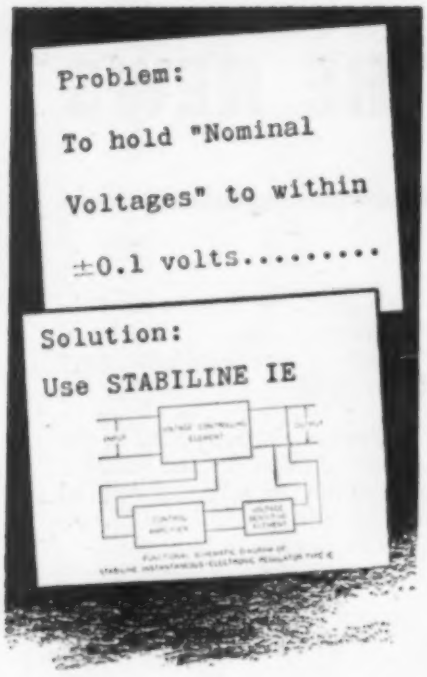
M. G. Gardner

Richard T. Ubben has been appointed technical director and **Elmer H. Koll** assistant technical director of Pittsburgh Plate Glass Co.'s Milwaukee paint division. **Morris G. Gardner** has been appointed technical director of the Newark, N. J., paint division succeeding Ubben who held that position for six years prior to his recent transfer.

Lorin G. Miller, authority in the field of heating and ventilation engineering has started his first school term as dean of engineering of Michigan State College at East Lansing. He succeeds **Henry B. Dirks,** retired.

Lancelot H. Rees and **George E. Bresette** have been appointed to the executive research staff of the Manton Gaulin Mfg. Co., Inc., of Everett, Mass. Mr. Rees, formerly with the Esselen Research Corp. of Boston, assumes the position of technical director and Mr. Bresette takes over the position of director of industrial development.

John M. Archiable has been appointed works manager for Emery Industries, Inc., Cincinnati. Succeeding Mr. Archiable as plant superintendent is **Robert Bruch,** also a chemical engineering graduate of the University of Cincinnati. Mr. Bruch's assistant will be **Milton Shear,** associated with Emery for 20 years. The three men



Your utility company may quote a nominal voltage — but power suppliers are allowed to vary, within certain limits, from the nominal. This condition, plus load changes in your own operation, results in voltages other than nominal. A STABILINE Automatic Voltage Regulator Type IE in your power line assures you of constant voltage. It's *instantaneous* in action — completely *electronic* in operation. Holds delivered voltages to within ±0.1 volts, regardless of line variation . . . within ±0.15 volts for any load current change or load power factor change from lagging .5 to leading .9. Maximum waveform distortion never exceeds 3 percent.

Rear View STABILINE Type IE

Bulletin 547 gives you information on this and other Superior Electric voltage control equipment. Write for your copy today.

THE SUPERIOR ELECTRIC COMPANY
210 Meadow Street
BRISTOL, CONN.

supervise all manufacturing operations at Emery's Ivorydale plant which includes the chemical, Twitchell, and plastolein divisions.

Frank Bachmann of the Dorr Co. has moved his headquarters to Orlando, Fla., and will handle all sanitary engineering work for the company in that state (except for the western section).

P. S. Shoaff

W. E. Forster

Paul S. Shoaff, formerly manager of Goodyear Synthetic Rubber Corp. operations at Torrance, Calif., but who has been acting in like capacity at the Houston plant, has returned to Torrance. He is succeeded at the Texas operations by **William E. Forster**, former superintendent of the Goodyear Tire & Rubber Co. operations in Venezuela. Forster has been at Houston working with Shoaff for several months.

Jonathan H. Sprague, Jr., has been appointed technical representative of Monsanto Chemical Co. in Washington, D. C.

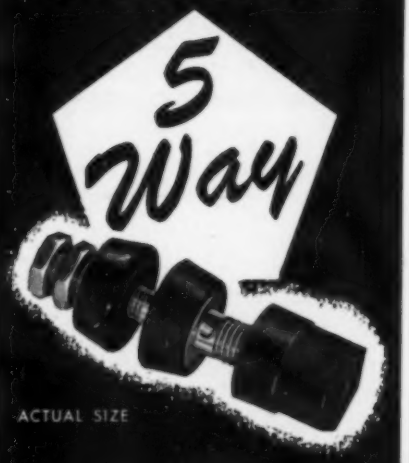
William B. Brooks, formerly consulting metallurgist in Pittsburgh, is now research and development engineer with the Dow Chemical Co. at Freeport, Tex., where he will continue his specialization in the fabrication, materials engineering and corrosion of process equipment.

Charles G. Crites has been appointed manager of the technical service division of Goodyear Tire & Rubber Co.'s plant in Buitenzorg, Java.

Saul Winstein received the $1,000 American Chemical Society Award in Pure Chemistry at the Midwest session of the Society last month in St. Louis. The pure chemistry prize won by Dr. Weinstein was established in 1931 by Alpha Chi Sigma, national chemical fraternity, to encourage fundamental studies by young chemists working in North America.

Clayton M. Beamer has been appointed to direct technical service on oxygenated solvents, hydrocarbons and aromatic chemicals for Enjay Co., Inc. Prior to his present appointment, Mr. Beamer was head of the technical serv-

THE SUPERIOR 5 Way



ACTUAL SIZE

BINDING POST
AVAILABLE NOW WITH CAPTIVE HEAD

The Superior Electric Company has developed this binding post to give complete insulation, 30 ampere current capacity and 1000 volt working voltage. The captive ½" hexagonal head eliminates fumbling—makes a fast, complete, multi-purpose electrical connector.

Features Five Connections

1. **Permanent clamping of wire up to #12 through center hole.**
2. **Looping of wire around center shaft and clamping.**
3. **Plug-in of standard ¼" banana plug.**
4. **Clip-lead connection by turning hex-shaped head to end of shaft.**
5. **Spade lug connection.**

The 5-WAY Binding Post, available in tough red or black phenolic plastic, is offered for immediate delivery. Write for descriptive literature today.

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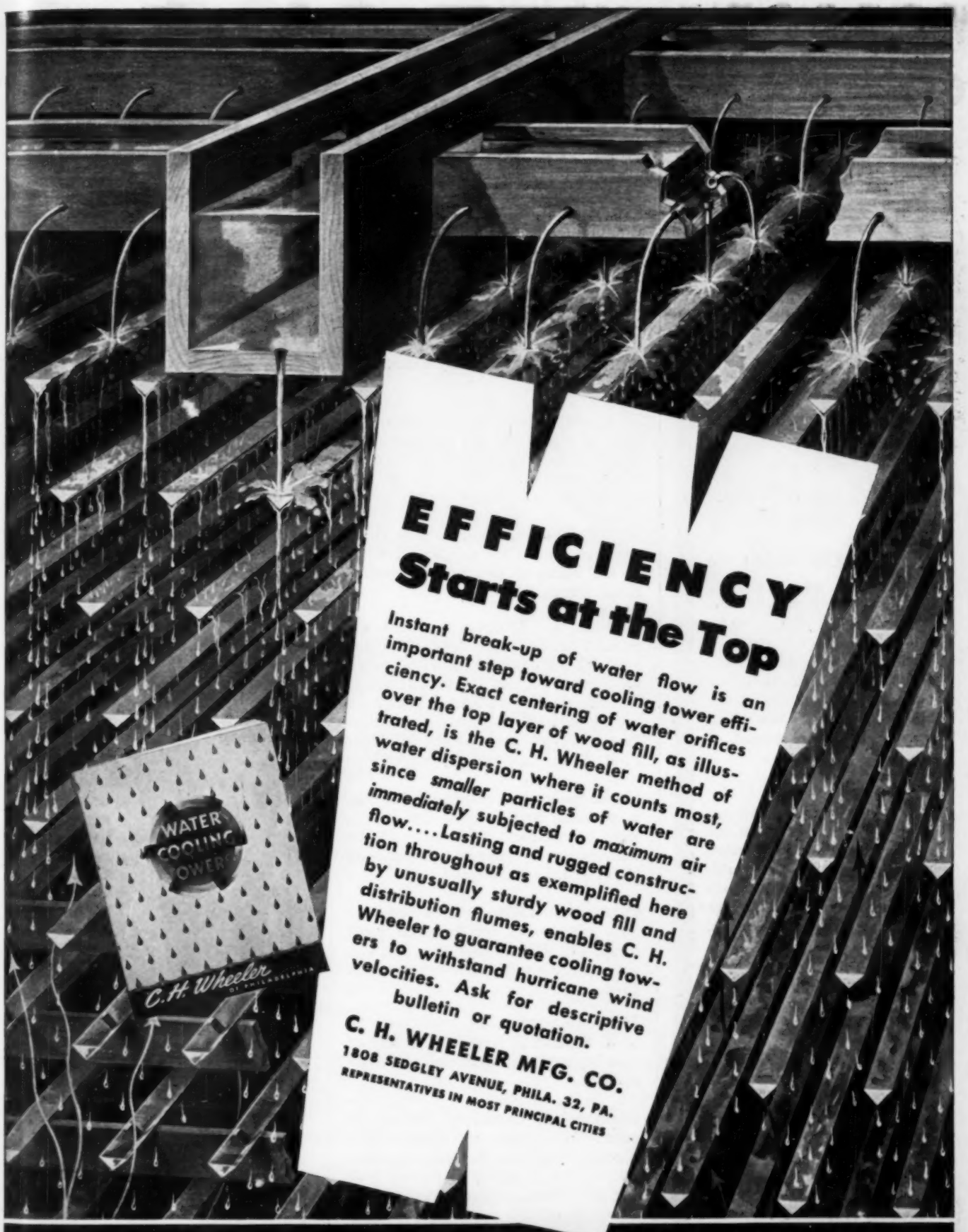


EFFICIENCY Starts at the Top

Instant break-up of water flow is an important step toward cooling tower efficiency. Exact centering of water orifices over the top layer of wood fill, as illustrated, is the C. H. Wheeler method of water dispersion where it counts most, since smaller particles of water are immediately subjected to maximum air flow.... Lasting and rugged construction throughout as exemplified here by unusually sturdy wood fill and distribution flumes, enables C. H. Wheeler to guarantee cooling towers to withstand hurricane wind velocities. Ask for descriptive bulletin or quotation.

C. H. WHEELER MFG. CO.
1808 SEDGLEY AVENUE, PHILA. 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

C.H. Wheeler

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS
OF PHILADELPHIA

MONARCH CORROSION RESISTANT NOZZLES

Of

Fig. F-80

STAINLESS STEEL:

Available in capacities from .57 G.P.H. Fig. F-80 style illustrated, to 104 G.P.M. (Fig. B-8-A style).

"Hollow" cone, "Solid" cone, and "Flat" sprays furnished in pipe sizes and capacities to suit practically any problem where corrosive liquids are sprayed.

STONEWARE:

Monarch Fig. 6020 and Fig. 6040 stoneware sprays have replaced most other types of nozzles used in acid chamber plants throughout the world. Last almost indefinitely in sulfur gases and will not break or crack from temperature changes.

HARD RUBBER:

Patented Fig. B-27 nozzle is of the "non-clog" type, i.e. it contains no internal vanes, slots, or deflectors which might facilitate clogging. Available ¼" to 1" pipe. Small sizes produce a very fine, soft, wide angle hollow cone spray, even at low pressures.

Fig. H-407 "flat" spray produces a relatively fine even sheet of liquid.

Write for Catalogs 6A and 6C

MONARCH MFG. WKS, INC.

2513 E. ONTARIO ST.

PHILADELPHIA 34, PA.

ice division of the chemical products department of Esso Standard Oil Co. at Baton Rouge.

Walter K. Zahray has been appointed chemical engineer in charge of a research project for the development of a new fuel component at Edwal Laboratories, Chicago.

D. P. Morgan, who recently joined Mathieson Chemical Corp. as administrator of research and development, has been appointed vice president in charge of the development department.

Charles D. Burton has been appointed manager of the Chemaco plant of Koppers Co.'s chemical division. Mr. Burton succeeds **Karl M. Joehnck** who resigned.

R. F. Boyer has been named director of the physical research laboratory of the Dow Chemical Co., Midland, Mich., and **W. C. Bauman** was appointed assistant director.

A. J. P. Wilson, consulting chemical engineer, New York, has been elected to the board of directors of Institutional Shares, Ltd.

William A. McIntyre has been appointed head of the Sherwin-Williams Co.'s Chicago lacquer laboratory. Two other S-W promotions involve **C. J. Dedert** and **H. W. Smock** who have been placed in charge of all manufacturing and plant operations under F. H. Lang, superintendent.

M. E. Barker has assumed his duties as professor and head of the department of chemical engineering at the University of Arkansas succeeding **H. T. Ward** who resigned recently.

Otto J. Hartwick has been named technical director of the Houston plant division of Pittsburgh Plate Glass Co. He has been with the company since 1926.

William Copulsky has joined the staff of R. S. Aries & Associates, where he will be engaged in chemical market research.

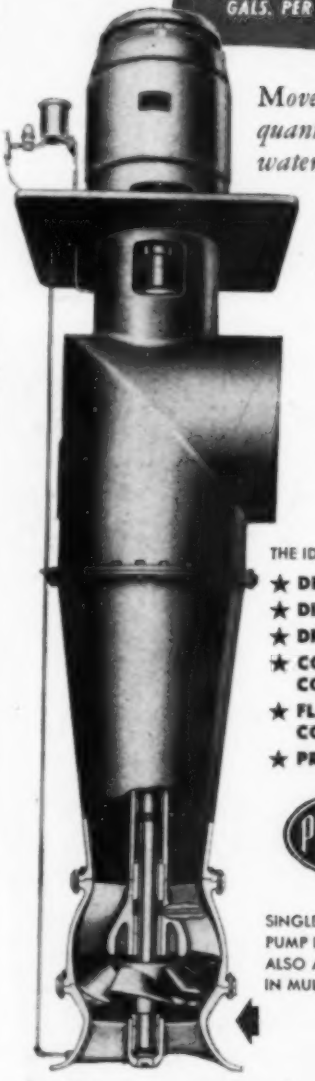
Courtland F. Carrier has severed his connection as associate director with Centro Research Laboratories Inc., and is now engaging in private practice as a chemical economist and research counsel.

D. H. Wheeler, head of the fats and oils section, General Mills Research Laboratories, Minneapolis, has been named head of the organization's chemical research department. In his new position, Dr. Wheeler will be

Giants IN THE WORLD OF PUMPING

PEERLESS MIXED FLOW PUMPS

FROM 600 TO **220,000** GALS. PER MIN.



Move maximum quantities of water against low and medium heads

THE IDEAL PUMP FOR:

★ DE-WATERING
★ DIVERSION
★ DRAINAGE
★ CONDENSER COOLING
★ FLOOD CONTROL
★ PROCESSING

PEERLESS PUMP

SINGLE STAGE PUMP ILLUSTRATED ALSO AVAILABLE IN MULTI-STAGE

The ideal pump for moving moderate to huge quantities of water against heads from 2 to 60 feet. Available with electric or other types of drive. Hydro-Foil (propeller type) pumps also available for similar services, capacities and heads. *Write for Bulletin B-148 illustrating and describing these pumps.*

PEERLESS PUMP DIVISION

Food Machinery and Chemical Corporation

FACTORIES: INDIANAPOLIS, IND.; LOS ANGELES 31, CALIF.
District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, California; Los Angeles 31, California

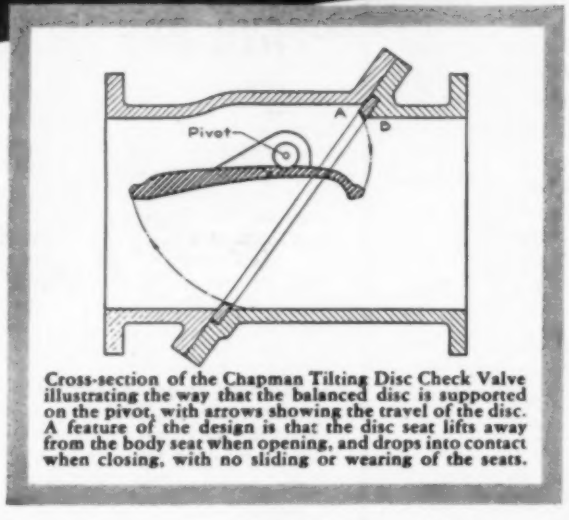
Floating Disc Action Gives

CHAPMAN

TILTING DISC

CHECK VALVES

Quick, Quiet Closing



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

Unlike ordinary check valves, Chapman Tilting Disc Check Valves have a balanced hinged-pin disc *which works with the stream.* The disc closes quickly and quietly, with its motion cushioned by the effect of the stream against the short flap. Since there is no slamming of the disc, hammering and pipe line stresses are eliminated.

Not only does this unique valve minimize maintenance costs but it also reduces head losses 65% to 85% over conventional type check valves. When installed on pump discharge lines substantial power savings are possible. Available in either iron or steel. **For engineering data and test results send for bulletin.**

THE **CHAPMAN** VALVE
MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

Thousands of Jelliff baskets of all sizes, give unusual service under a wide variety of conditions. Jelliff baskets are designed and engineered to provide maximum performance and economy on the job. Special types can be produced to specifications in the Jelliff plant with its complete facilities for drawing, weaving and fabricating. Available in aluminum, brass, copper, monel, steel, stainless nickel and other metals and alloys.

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The C. O. JELLIFF MANUFACTURING CORPORATION

SOUTHPORT, CONN.

WIRE PRODUCTS Jelliff SINCE 1860

responsible for all organic chemical research, including the development of fatty acids, new drying oils, synthetic waxes, chemical derivatives of wheat starch and protein, soybean products and other new organic chemicals.

William D. Kring has been appointed chief engineer of Semet-Solvay division, Allied Chemical & Dye Corp. He has been associated with the division and its predecessors for many years. Mr. Kring succeeds the late **Julius Becker**, who had served the division and its predecessors continuously for 36 years.

Philip V. Cardon has been named to head the Agricultural Research Administration. Dr. Cardon fills the position being vacated by **W. V. Lambert**, who has resigned to become dean of the Nebraska College of Agriculture and director of the Nebraska Agricultural Experiment Station.

P. V. Cardon

F. J. Hood

F. J. Hood has been elected president of Ansul Chemical Co., Marinette, Wis. He succeeds **Harvey V. Higley**, who has been named chairman of the board of directors.

S. David Bailey has been appointed head of the physical chemistry section of the research laboratories of Smith, Kline & French, Philadelphia.

C. C. Schulze has been made a section leader in the vat colors section of the process development department of General Aniline & Film Corp.'s Grasselli, N. J. plant. **Robert C. Wilson** has been made section leader in the Ansco photographic chemicals section and **Joseph S. Milazzo** assistant production supervisor in the vat colors department.

Richard E. Reynolds has been named branch manager of the Atlanta office of Sylvania division American Viscose Corp. and vice president of Sylvania Industrial Corp. of Georgia succeeding the late E. C. Nation.

Harold A. Beatty has been appointed to the newly-created position of assistant director of research at the Ethyl Corp. research laboratories in Detroit. Previous to his new assignment, Dr.

PROCESSED AMOSITE ASBESTOS FIBRES

•

FOR FILTRATION, PLASTIC REINFORCEMENT AND OTHER INDUSTRIAL USES

Amosite is an extremely long acid resistant asbestos fibre mined in South Africa. It is especially suitable for filtration and similar processes. Available in various grades and degrees of opening to meet specific requirements.

UNION ASBESTOS & RUBBER CO.

UNARCO

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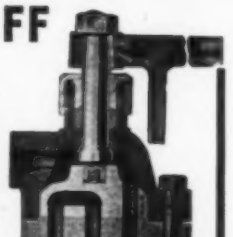
STANDARDIZING *on Nicholson Valves* PAYS OFF



Style E for air, gas, oil, steam, water; pressure to 500 lbs.

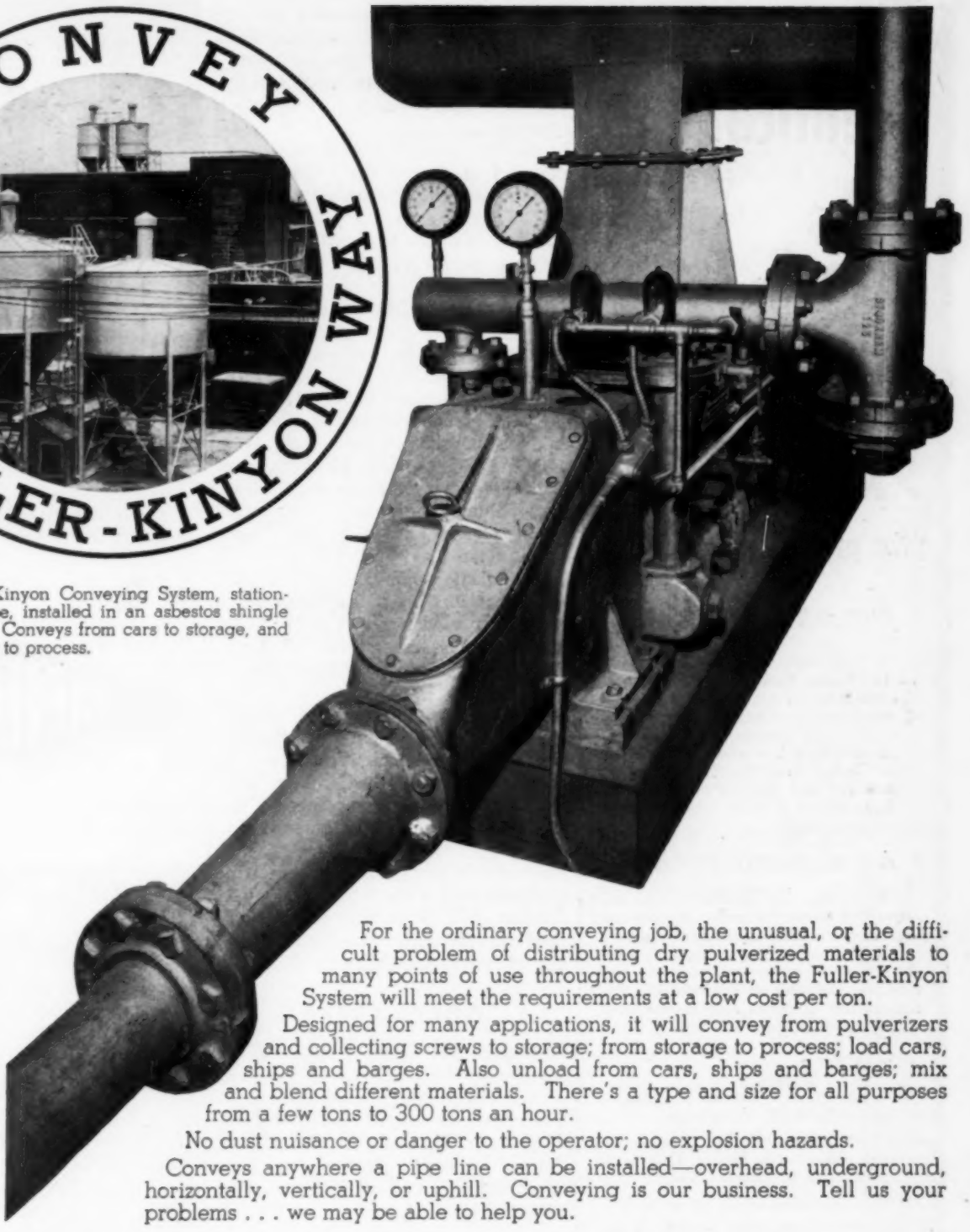
A survey of large users of Nicholson cylinder control valves shows these leading reasons for their specification: 1) Special seats, don't cut out. 2) Fast, positive acting. 3) Stuffing box easily repacked. 4) heavy-bodied, take abuse. 5) Neat, installed in any position. Nicholson control valves are furnished for all mediums and types of operation — lever, foot, solenoid and motor. Choice of 6 metal combinations to meet specific needs. Pressures to 5000 lbs.

Style H, pressure to 5000 lbs.

Catalog 546

W. H. NICHOLSON & CO.

206 Oregon St., Wilkes-Barre, Pa.



Fuller-Kinyon Conveying System, stationary type, installed in an asbestos shingle plant. Conveys from cars to storage, and storage to process.

For the ordinary conveying job, the unusual, or the difficult problem of distributing dry pulverized materials to many points of use throughout the plant, the Fuller-Kinyon System will meet the requirements at a low cost per ton.

Designed for many applications, it will convey from pulverizers and collecting screws to storage; from storage to process; load cars, ships and barges. Also unload from cars, ships and barges; mix and blend different materials. There's a type and size for all purposes from a few tons to 300 tons an hour.

No dust nuisance or danger to the operator; no explosion hazards.

Conveys anywhere a pipe line can be installed—overhead, underground, horizontally, vertically, or uphill. Conveying is our business. Tell us your problems . . . we may be able to help you.

FULLER COMPANY

CATASAUQUA, PENNSYLVANIA

Chicago 3 - 120 So. LaSalle St.
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FULLER COMPANY

FULLER-KINYON, FULLER-FLUXO AND THE AIRVEYOR CONVEYING SYSTEMS . . . ROTARY FEEDERS AND DISCHARGE GATES . . . ROTARY AIR COMPRESSORS AND VACUUM PUMPS . . . AIR-QUENCHING INCLINED-GRATE COOLERS . . . DRY PULVERIZED-MATERIAL COOLER . . . AERATION UNITS . . . MATERIAL-LEVEL INDICATORS . . . MOTION SAFETY SWITCH . . . SLURRY VALVES . . . SAMPLERS

P-91

no chemical can attack TEFLON PACKING

for pumps and valves

• *for example:*

"A year ago a set of our Style #101 Plastic Teflon Packing Rings was installed in a glass-lined chemical reactor handling a very corrosive chemical solution at the chemical manufacturing plant of Otto B. May, Inc., Newark, New Jersey. Previously this reactor required repacking twice a week with conventional packing.

• *no deterioration*

"Recently, our packing was removed in order to make repairs on the reactor. The same packing was reinstalled after repairs on the reactor were completed because the packing showed no appreciable deterioration or wear and is continuing to give perfect service."

• *styles*

No. 101 Plastic Teflon Packing—compounds with Graphite

No. 201 Plastic Teflon Packing—compounded with Mica. This style for use with stainless steel.

Gaskets covered with pure teflon.

All styles thoroughly tested. Withstand any corrosion conditions at temperatures from —80° F. to 525° F.

Teflon packings are compounded by a process which reduces the friction found in pure teflon, yet retains all its chemical resistance.

• *80 . . .*

wherever, whenever you have a nasty packing or gasket problem, call on

POWER PRODUCTS CO.

11 Broadway New York 4, N. Y.

Beatty was technical assistant to the general manager. He has been succeeded in that position by **O. Edward Kurt** who has been transferred to Detroit from Baton Rouge.

Benton R. Cancell has resigned as vice president of Powell River Co., Ltd., and rejoined the St. Regis Paper Co.

Charles F. Gerlach has been appointed technical service manager, agricultural chemicals, at Michigan Chemical Corp., St. Louis, Mich.

Warren A. Beman, process products engineer in the industrial district of the Socony-Vacuum Oil Co. at Albany, has been transferred to the chemical products division in New York as a staff engineer. **G. H. Hocking,** formerly a process products engineer in the Philadelphia division, has replaced Mr. Beman in Albany.

E. E. Baker, formerly director of development for Emery Industries, Inc., has been named manager of the Central Research Laboratories of Continental Oil Co., Ponca City, Okla.

R. F. Hazelton of Midland, Mich., has been named a member of the faculty of the department of chemical engineering at North Carolina State College. Dr. Hazelton comes to the college from the Dow Chemical Co.

Harry G. Warren, Atlanta, Ga., district manager for the mechanical goods division of U. S. Rubber Co., has retired after 25 years of continuous service. He came to Atlanta in 1938.

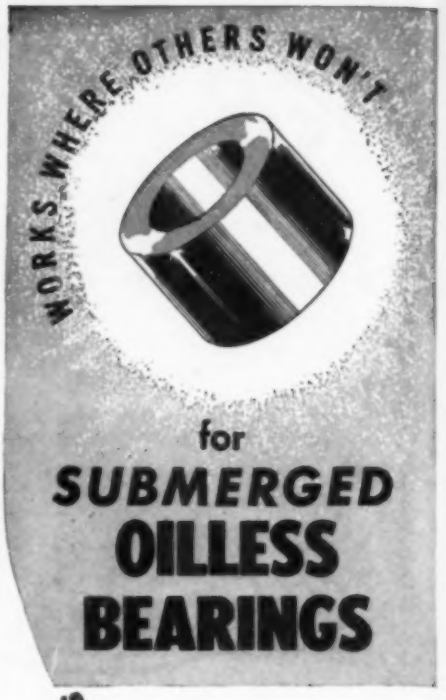
OBITUARIES

Lawrence M. Druckenbrod, 62, a member of the Austin Co.'s Cleveland district engineering organization since 1915 and its district engineer from 1930 to 1941 when he was named Austin's project engineer on Dow Chemical Co. work at Houston, died August 14.

Raymond E. Palmer, 57, United States Rubber Co. engineer and project manager at the Mexico City plant of United States Rubber Export Co., Ltd. died at Mexico City August 26.

Elmer C. Nation, 57, vice president of Sylvania Industrial Corp. of Georgia and branch manager of the Atlanta office of Sylvania Division American Viscose Corp., died in Atlanta, September 4.

Aldus C. Higgins, 75, chairman of the executive committee of the Norton Co., Worcester, Mass., died September 10.



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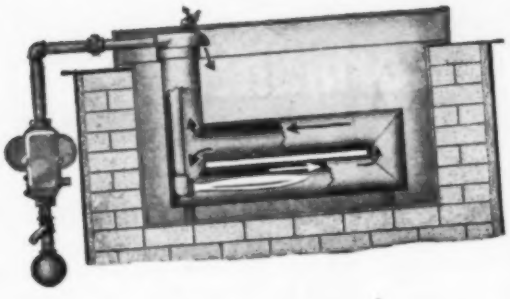

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INDUSTRIAL NOTES

Esso Standard Oil Co., New York, has appointed Richard J. Kaul manager of the operations and planning division of the chemical products department.

Mathieson Chemical Corp., New York, has named Frank W. Thomas assistant general manager of sales.

B. F. Goodrich Co., Akron, is building a multi-million dollar plant for the manufacture of industrial rubber belting.

Tennessee Eastman Corp., Kingsport, Tenn., has started work on a new research laboratories building.

Eutectic Welding Alloys Corp., New York, has appointed Robert H. Groman to the board of regional sales supervisors.

American Car and Foundry Co., New York, has named Sheldon Thomas assistant district manager of its Chicago, Ill., plant.

Timken Roller Bearing Co., Gambrinus, Ohio, has placed into operation a new $80,000 acid disposal plant which will treat 550,000 gal. of waste acids from the Canton and Gambrinus steel mills each month.

Monsanto Chemical Co., St. Louis, will move its Lockport plant to the company's plastics division at Springfield, Mass.

E. I. du Pont de Nemours & Co., Wilmington, has closed down its Grasselli chemical division plant at Niles, Ohio, for 30 days while a new burner building is being constructed to replace the old department.

Quaker Oats Co., Chicago, has transferred James J. Howe from Chicago to its eastern sales office in New York City.

Houdry Process Corp., Philadelphia, has appointed Robert Andrews assistant to the president.

Yale & Towne Mfg. Co., New York, has appointed Otto G. Schwenk vice president in charge of production.

Stainless Products, Inc., Elizabeth, N. J., has elected M. K. Schnurr president and treasurer and director. P.

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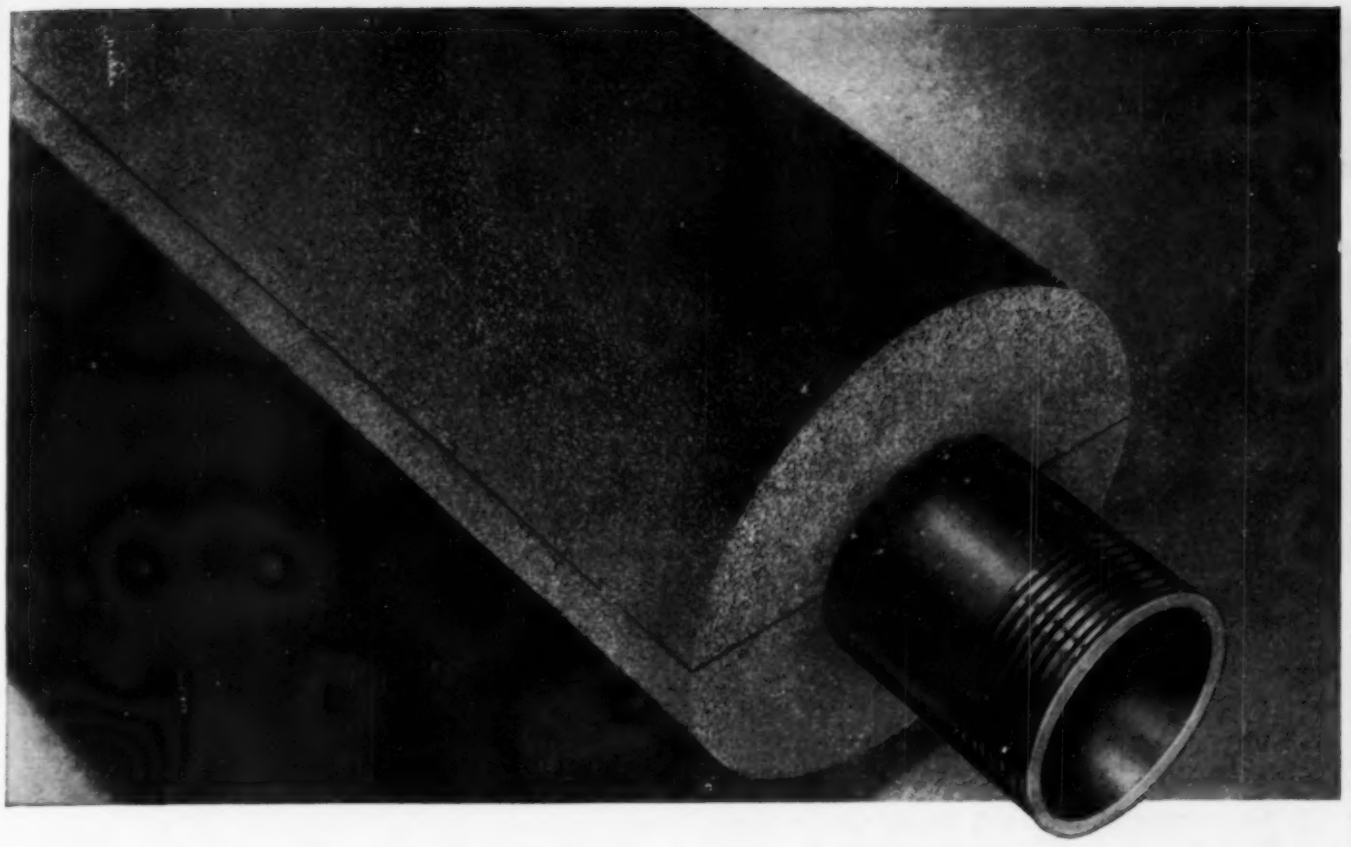

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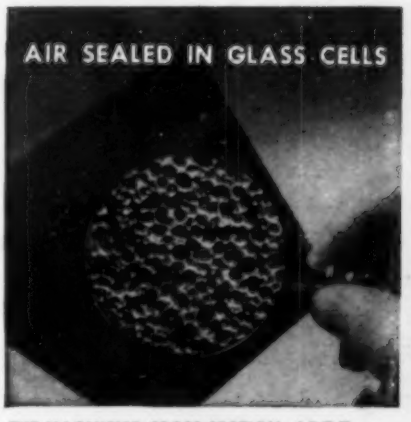

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A WHOLLY OWNED SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

F. McEvoy has been elected vice president and director and H. F. Wyman has been elected a vice president and director.

Hercules Powder Co., Wilmington, has made Robert W. Crabtree resident manager of its Los Angeles office succeeding Lawrence W. Early. Mr. Early has been transferred to the company's Salt Lake City office.

Sam Tour & Co., Inc., New York, has named Leslie S. Fletcher to its presidency.

Eutectic Welding Alloys Corp., New York, has appointed G. Luke Mizell to its board of regional sales supervisors.

Koppers Co., Inc., Pittsburgh, has named Sam C. Whitehouse export manager of the chemical division's sales department.

General Electric Co., Pittsfield, Mass., has appointed the Graybar Electric Co. national distributors for the resin and insulation materials division of its chemical department.

Heath Refinery Co., Newark, Ohio, has a new fluid catalytic cracking unit.

Interchemical Corp., Cleveland, is transferring all manufacturing operations and office functions of its Murphy paint division from Chicago to Wooster, Ohio.

American District Steam Co., North Tonawanda, N. Y., has opened a branch office at 1922 Oliver Bldg., Pittsburgh, under the supervision of J. A. Gustafson.

Harrington & King Perforating Co., Chicago, Ill., has appointed David K. Colesberry as general sales manager.

Rapids-Standard Co., Inc., Grand Rapids, Mich., have adopted the term RapiStan as a trademark to designate all equipment manufactured in its line.

Sintering Machinery Corp., Netcong, N. J., has made Reed W. Hyde president.

Oil States Petroleum Co., New York, has made James Watson assistant to the president.

Eutectic Welding Alloys Corp., New York, has appointed William R. Bajari to the board of regional sales supervisors.

Babcock & Wilcox Co., New York, has appointed Robert J. Powell refrac-

COMMERCIAL-SCALE

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PLANTS ARE NOW OPERATING!

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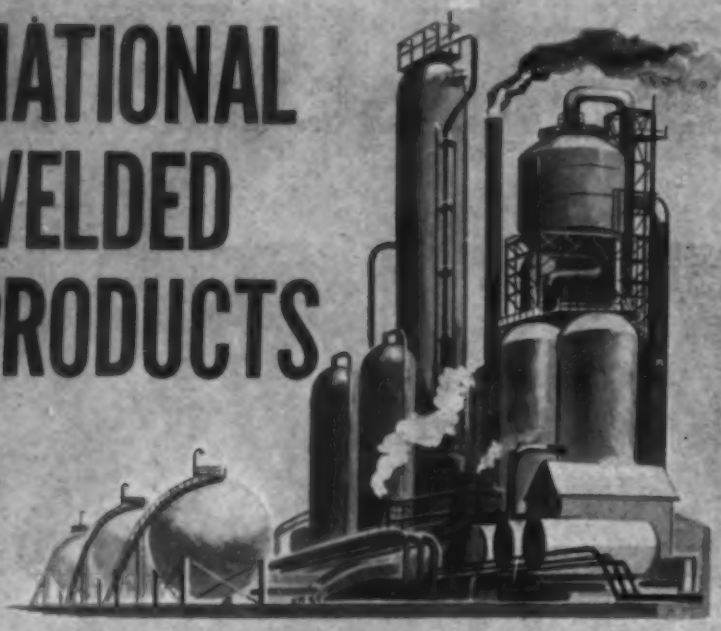

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WASHINGTON, PENNA.

tory sales engineer for Alabama, Tennessee and western Georgia and Florida.

Oronite Chemical Co., San Francisco, a subsidiary of Standard of California, has appointed T. M. Welton central district manager of its product development department.

Rockwell Mfg. Co., Pittsburgh, has appointed E. E. Hedene to chief engineer of all operations of the Nordstrom Valve Division.

Merck & Co., Inc., Rahway, N. J., will erect new office and warehouse facilities for its St. Louis, Mo., branch.

Glidden Co., Cleveland, has reported its sales for the nine months ending July 31 to be $15,617,788 over the total for the same period of 1947

Humphrey-Wilkinson Inc., New Haven, Conn., a new company, has been set up after the purchase of the chemical division of the Connecticut Hard Rubber Co.

Tube Turns, Inc., Louisville, has elected John G. Seiler executive vice president.

Girdler Corp., Louisville, has elected W. Roberts Wood executive vice president.

Freeport Sulphur Co., New York, has elected James O. Winston to its board of directors.

Socony-Vacuum Oil Co., Inc., New York, has awarded fellowships to James J. Donnelly and F. A. Angona.

Ansul Chemical Co., Marinette, Wis., has appointed W. R. Rinelli director of its new customer relations department.

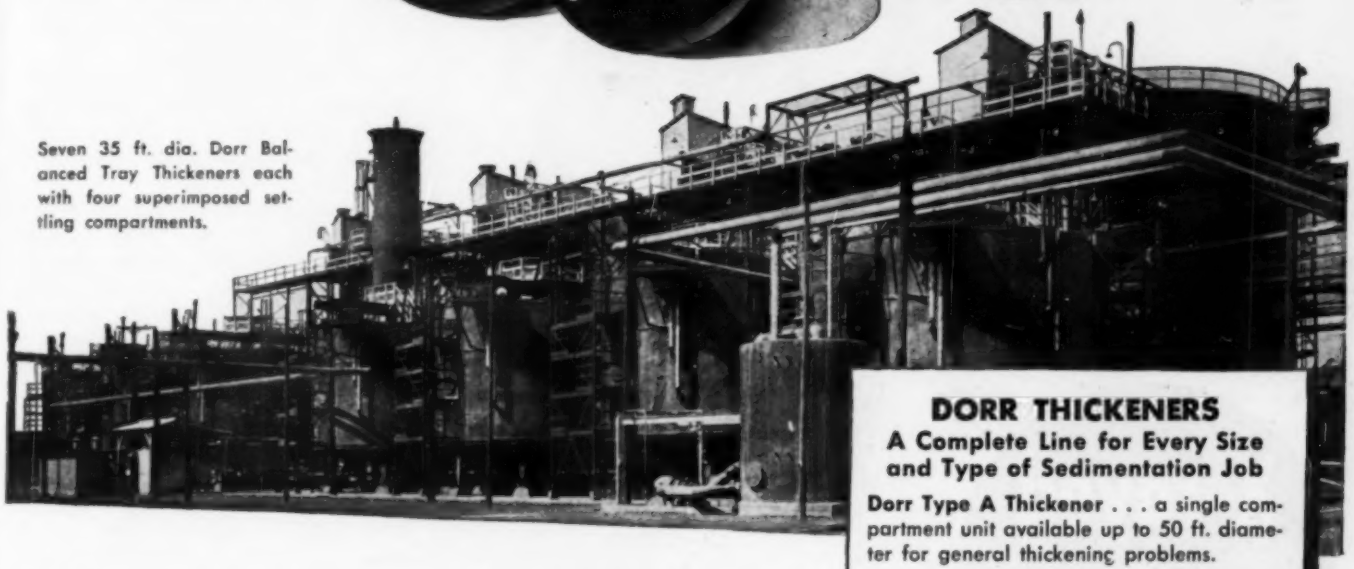
E. I. du Pont de Nemours and Co., Wilmington, has made Leslie B. Gillie assistant director of industrial sales in the plastics department. Edward J. Pechin and P. Willard Crane have been made assistant sales directors reporting to Mr. Gillie.

Diamond Alkali Co., Cleveland, has elected Arthur W. Crossley treasurer.

Diamond Alkali Co., Cleveland, Ohio, has appointed Henry B. Clark manager of the New York sales office.

U. S. Rubber Co., New York, has appointed Duane R. Stoneleigh sales manager for agricultural chemicals.

General Electric Co., Schenectady, has named John B. Land manager of sales



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Dorr Type A Thickener . . . a single compartment unit available up to 50 ft. diameter for general thickening problems.

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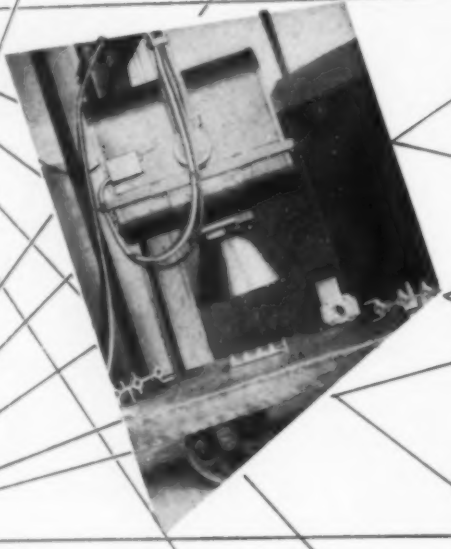

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for the petroleum and chemical industries section of its materials industries division.

Dow Chemical Co., Midland, Mich., has reported a gross income of $174,353,190 for the fiscal year ended last May 31. This is 31 percent above last year's level.

Barton Distilling Co., Bardstown, Ky., has bought the government-owned portion of its plant for $120,000.

Cole Laboratories, Inc., and Retort Pharmaceutical Co., Inc., have purchased a plant in Long Island City, N. Y., from the Defense Plant Corp

Houdry Process Corp., Philadelphia, has named John E. Weber as manager of the planning department of its subsidiary, Catalytic Construction Co.

Minneapolis-Honeywell Regulator Co., Minneapolis, has named Ray R. West manager of sales of products for industrial applications. Lloyd E. Slater has been appointed industry engineer in charge of food industry applications for measuring and controlling devices.

Allis-Chalmers, Milwaukee, has named T. J. Hodan manager of its water conditioning department.

Norton Co., Worcester, Mass., has appointed George C. Gibbons resident manager of its bauxite plant in Bauxite, Ark. He succeeds C. Lawton Rucker who is retiring.

Sharples Corp., Philadelphia, has elected G. Joseph Keady president. Philip T. Sharples, former president, now becomes chairman of the board.

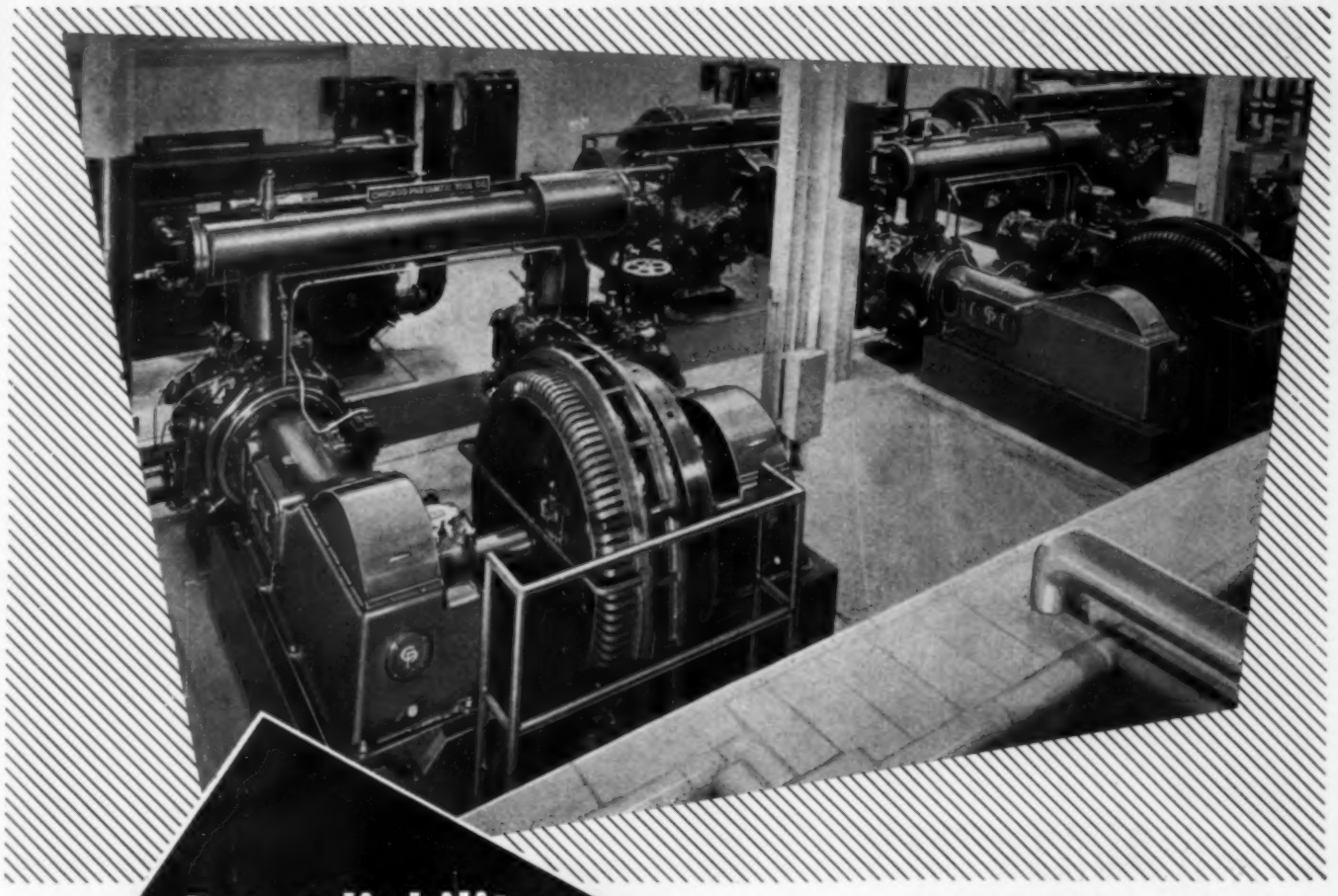
Catalytic Construction Co., Philadelphia, has been given the contract covering the modernization of the Ashland Oil and Refining Co.'s Houdry TCC catalytic cracking unit.

B. F. Goodrich Co., Akron, has begun construction of a new building at its Tuscaloosa, Ala., plant for the fabrication of rubber tank lining.

American Car and Foundry Co., New York, has appointed Henry V. Bootes its assistant vice president.

Minneapolis-Honeywell Regulator Co., Minneapolis, has started a three-year expansion program of its Brown division.

Tri-Clover Machine Co., Kenosha Wis., has appointed Richard M. Bode vice president in charge of sales and C. J. Mader vice president of the fabricating division in Cudahy, Wis.



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Its excellent features include: quick-acting Simplate valves that minimize power consumption and provide high volumetric efficiency . . . large, streamlined air passages that make air flow resistance negligible . . . the CP Multi-Step Control for handling partial load demands with economy . . . the CP Intercooler that assures maximum heat transfer with low water consumption . . . and the CP Automatic Starting Unloader that completely unloads compressor when starting and stopping.

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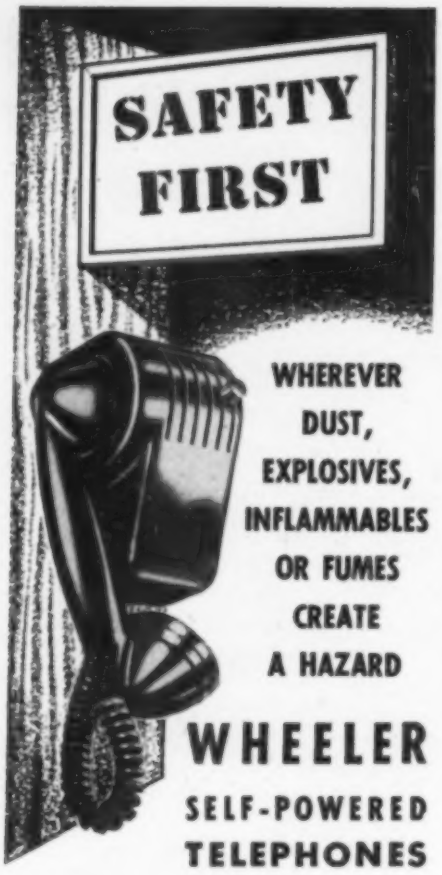

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CONVENTION PAPER ABSTRACTS

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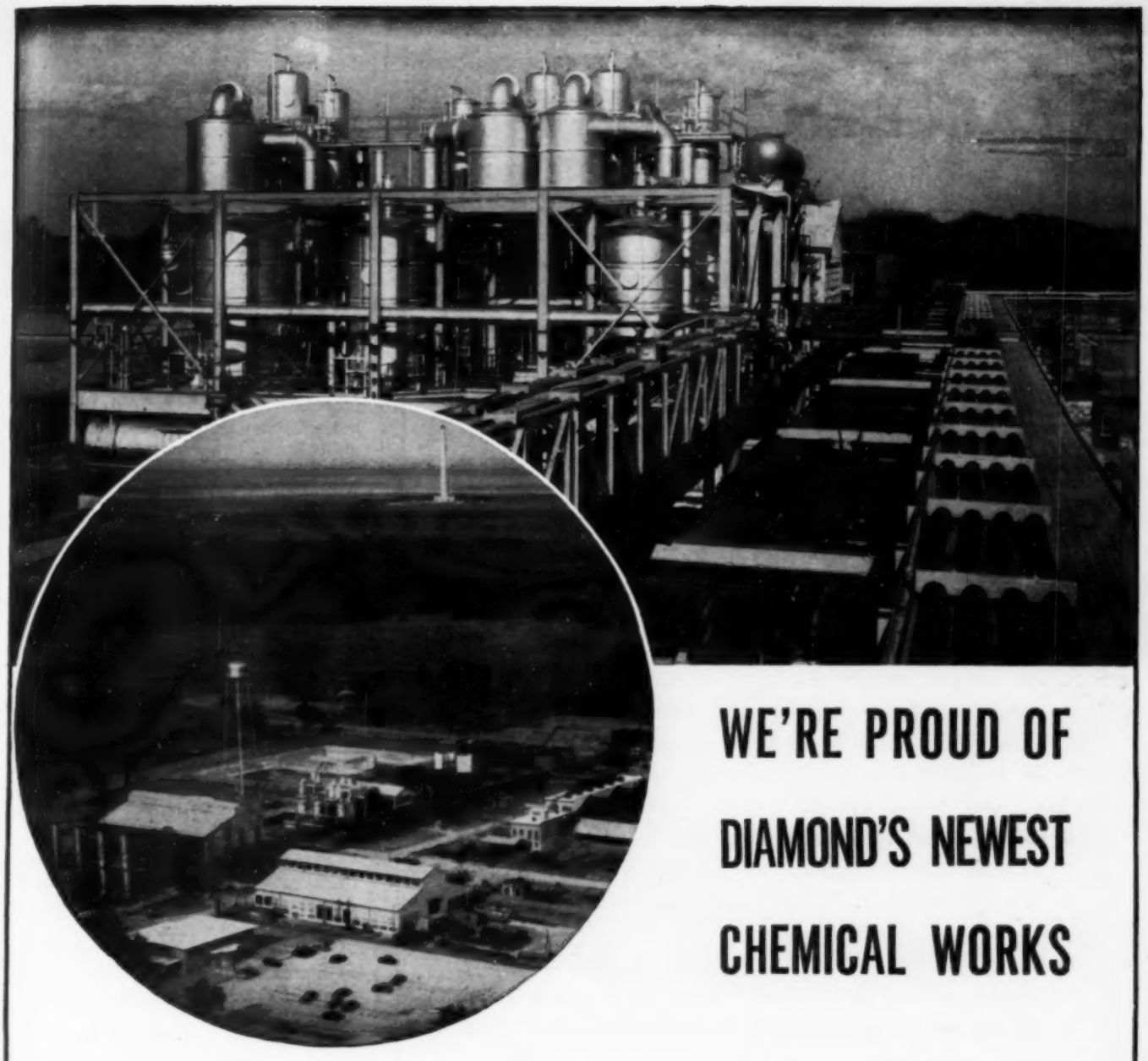

WE'RE PROUD OF DIAMOND'S NEWEST CHEMICAL WORKS

Diamond Alkali Company's newest chemical plant, the Houston Works on the Houston Ship Channel, recently went on stream, manufacturing chlorine and caustic for what it's able young president, R. F. Evans, so aptly described as "the living, growing, expanding chemical industry." Brown & Root, Inc. are proud to have been selected for engineering and construction of this great plant—proud of the part we have in the process industry in the Southwest, which is fast securing its position as a world chemical capital.

BROWN & ROOT, Inc.

P. O. Box 2634 Houston 1, Texas

LARGE ENOUGH FOR *YOUR* JOB

SMALL ENOUGH FOR PERSONALIZED SERVICE

- **G-B IS LARGE ENOUGH** to handle specialized jobs from start to finish in its modern plant. A foundry of 70,000 square feet floor area, equipped to produce any kind of grey iron or alloy iron casting of any shape or size up to 40 tons. A plate and welding shop, experienced in fabricating all classes of sheet steel and special materials, such as dexodized copper, stainless steel and other special alloys. A machine shop, completely equipped with all sizes and types of machine tools, including a 26' diameter boring mill and a 26' stroke planer.

- **G-B IS SMALL ENOUGH** to give your job personalized service. Practically every job that goes through our plant is a *special* job and must have *special attention.*

- **G-B IS EXPERIENCED ENOUGH** to have the ingenuity, know-how and adaptability. Through 66 years it has maintained its leadership in the chemical process field.

Whatever your requirements, G-B has the machines, the men and the know-how.

We invite your inquiries.

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hydes should simplify the preparation of various amino acid derivatives of thiophene.

F. F. Nord and William J. King, Fordham University, before the American Chemical Society, Washington, D. C., Aug. 30, 1948.

Introducing Safety

SAFE and efficient operation of chemical enterprise is becoming more and more imperative, because it is an economic as well as a humanitarian problem. Unless technical students are given the proper introductory training and perspective in safe practices, supplementing academic training, the transition from college to the commercial laboratory frequently is both difficult and dangerous.

Accident prevention, fire protection, first aid, toxicity of chemicals, and industrial hygiene are among the topics emphasized in the safety campaign which is being conducted by 44 collegiate chapters of Alpha Chi Sigma in leading chemistry and chemical engineering schools.

Among the specific projects being carried out in connection with the drive are the following:

A complete survey of laboratories with recommendations for correction of unsafe conditions submitted in a report to those in authority and followed up until corrected.

Clean-up drives in laboratories.

Publicizing of often-fatal consequences of experiments with explosive compounds by unqualified persons and youngsters.

Demonstrations and practice in use of fire extinguishers, gas masks, emergency showers, fire blankets and artificial respiration.

A "Safety Night" in which off-campus speakers discuss safe practices in chemical and engineering laboratories.

Publication of accident abstracts and appropriate articles in fraternity magazines.

Printing of safety posters. Four are now being distributed generally and more are planned.

Howard Fawcett, National Safety Council of Alpha Chi Sigma, before the American Chemical Society, Washington, D. C., August 31, 1948.

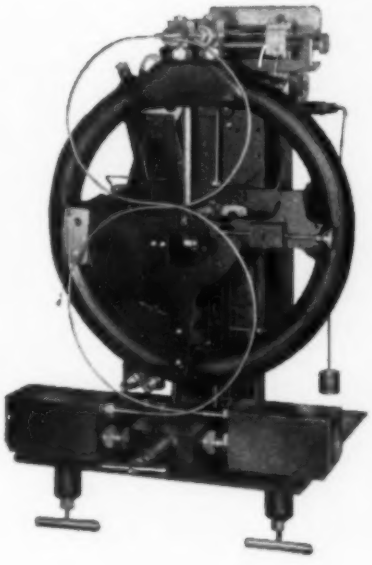
Zirconium Produces Promising Pigments

UNTIL recently, little advantage was taken of the unusual properties of zirconium for preparing commercially important pigments of great brilliance from solutions of basic and acid dyes. Acid dyes are formed by adding such alkaline metals as calcium and aluminum to dye solutions, and basic dyes by adding metallic acids such as

There is a *Standard Model*

HAGAN RING BALANCE FLOW METER

for *Static Pressures up to 10,000 p.s.i.*



The basic principle, the indicating and recording features, the method of range adjustment, the integrator, the case,—these are exactly the same as with other Hagan Ring Balance Flow Meters—*but this Series 2300 meter will handle static pressures up to 10,000 p.s.i.* It provides a record which is proportional to either the differential or to the rate of flow, as desired.

Maximum differential head is 140 inches for the one-ring model, 280 inches for the two-ring model. Minimum differential can be low enough to permit use of this meter for liquid level applications and others which would not be practicable if excessive differentials were required to operate the meter.

As in other Hagan Ring Balance Meters, there are *no stuffing boxes*, and therefore virtually no danger of leakage.

For full information on this and other Hagan Ring Balance Flow Meters, write for Hagan Bulletin 2M48.

Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

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RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

An Invitation to Plant Managers in the CHEMICAL INDUSTRY
Automatic proportioner . . . for two or more liquids . . . with patented, precision volumetric meter control. Records quantity of each ingredient as well as finished product.
Automatic unit fills containers in predetermined quantities—one pint to nine quarts. Temperature control and specific gravity adjustment.
Bowser Industrial Xacto Meters accurately measure liquids ranging from acids to wood oil. Gray cast iron, brass, bronze or stainless steel construction.

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You are invited to explore the possibilities for similar economies in your plant through:

1 More production with less labor, space and capital investment.
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If accurate measurement of liquid movement in your plant will help you to do a better job . . . more economically . . . Bowser can help you NOW!

May we get together—at your convenience, and without any obligation on your part—to determine whether or not your plant can use Bowser meters profitably? Just write and name the date.

BOWSER, INC., 1302 Creighton Avenue, Fort Wayne 2, Indiana

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tungstic and molybdic acids, in conjunction with phosphoric acid.

Zirconium is unusual because of its ability to serve either as an acid or a base, depending on the conditions of the chemical reaction involved. A product made possible by this property is a basic zirconyl salt which yields a brilliant red pigment of soft texture. Pigments of this type have a higher tinctorial strength than comparable pigments now on the market and promise greatly improved color printing.

Other zirconium compounds produce pigments having lower raw material costs than those on the market, particularly in comparison with the tungstic acid colors.

Aside from their use in the preparation of pigments the reactions of the zirconium compounds with dyes have potential value in the purification of dyestuffs, the fixation of dyes on fabrics and the decolorization of liquids. The reactions shed considerable light on the chemistry of zirconium. The capacity of this element to form certain ions under certain conditions, and complex electronic structures under others, reveals new ramifications of zirconium chemistry of both theoretical and practical value.

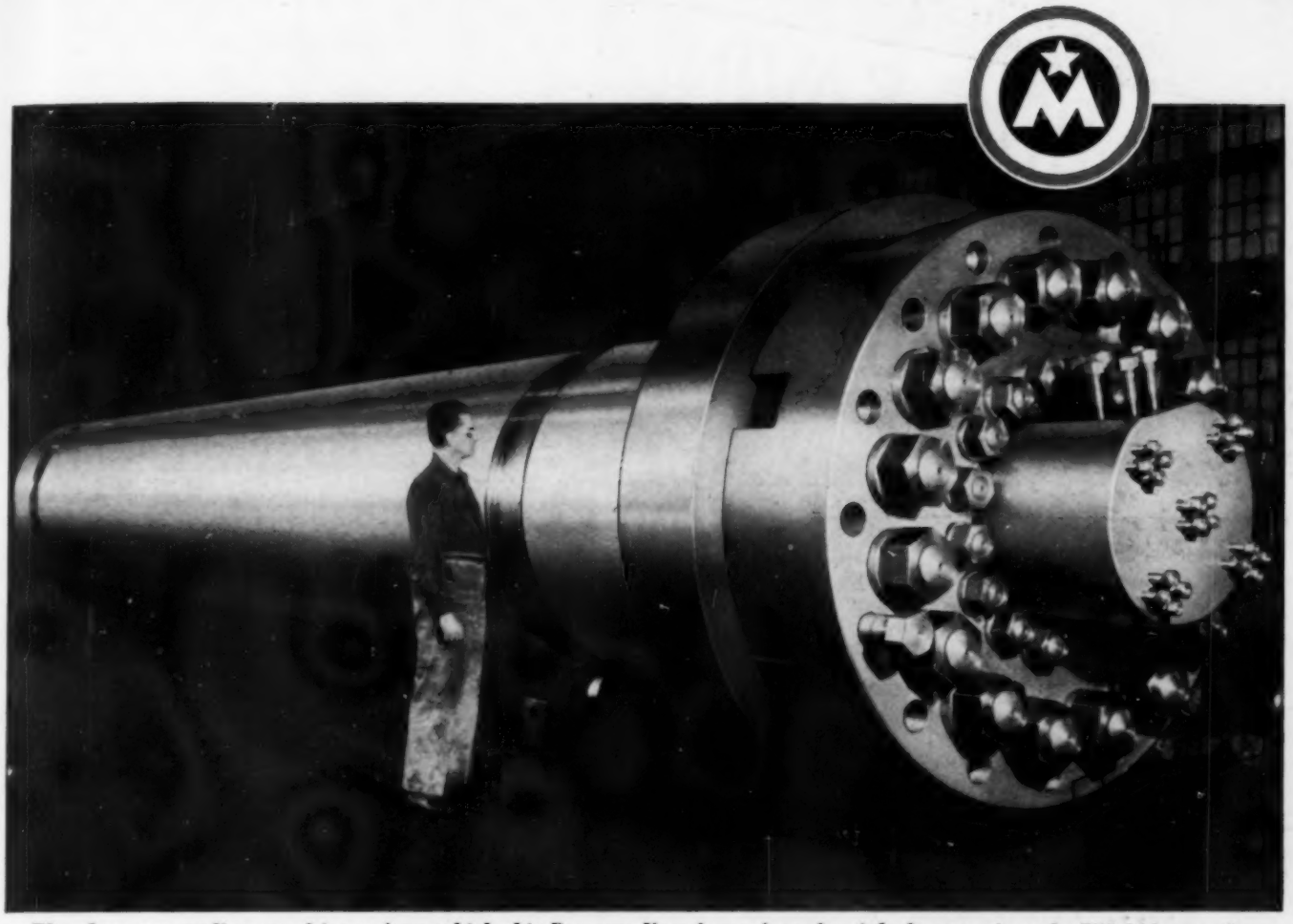
Warren B. Blumenthal, Titanium Alloy Manufacturing Co., before the American Chemical Society, Syracuse, N. Y., June 28, 1948.

Science, Secrets and Security

CONFLICT of interests which arise from official secrecy regarding military applications of science and that freedom of inquiry which is necessary for the continued growth of science represents one of the most important problems of science today. By virtue of the intimate relationship between science and technology, the problem also and inevitably becomes one of great importance to the national welfare.

The motivation behind the restriction of scientific information is simple, but the whole problem has become unnecessarily complicated and confused as a result of loose terminology, confusion as to what might be attained through a classification program, and the present fears prevalent throughout the world. Unless the problem is carefully considered and understood, however, we stand in grave danger of defeating through ignorance or stupidity the very ends which we seek to gain.

This matter of keeping scientific information classified is a complicated one. If we are to attain those limited objectives of security through military security, we must progress in the sciences, because military strength rests on science and because the "secrets"



The chrome vanadium steel ingot from which this Pressure Vessel was forged weighed approximately 550,000 pounds.

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Midvale makes one piece hollow Forged Pressure Vessels for the chemical, refining and process industries under the watchful eye of the Midvale quality control system. Midvale quality control starts with the design and is maintained through all operations to the finished product.

The big fellow pictured here, for instance, was inspected by trained engineers at every step of the way from design to pressure testing. Every Midvale forged pressure vessel, regardless of size, is so inspected and controlled, assuring safety and quality.

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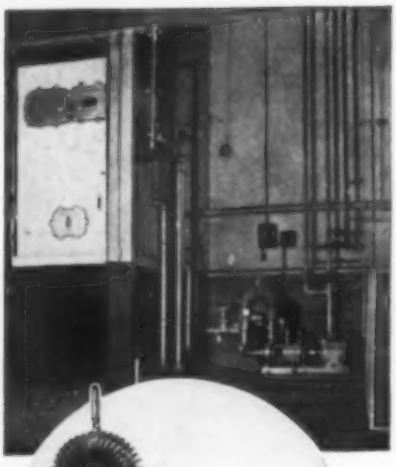
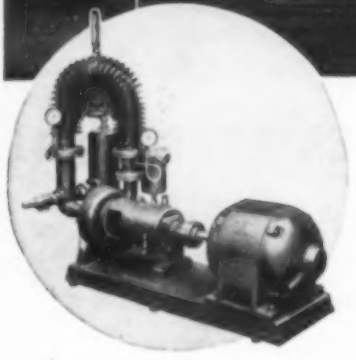




Reading Dyeing Co., Inc. Find C-B System Saves Drying Time

Everybody wants to save money! But when savings result from the utilization of otherwise wasted material . . . plant operators become enthusiastic.

That's the way the Reading Dyeing Company feels about their Cochrane C-B system — *enthusiastic!* Why? Simply because it puts waste heat units to work.

For instance, in this "closed circuit" system of condensate return no heat is lost in the flashing of steam to atmospheric pressure. Instead, it is put to work in the dryers . . . saves 20% drying time. And that isn't all . . .

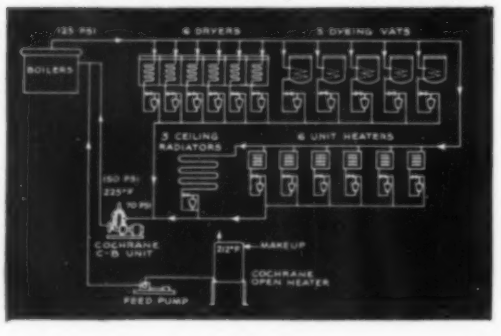
Since no condensate is lost in flashing, treatment of makeup water is materially reduced. Fuel costs go down, too, because water is returned to the boilers at 225°F. In fact, one of the boilers in the plant has been cut out and is now used only for standby purposes.

This enthusiasm of the Reading Dyeing Company for this C-B unit is merited, indeed—and it isn't unusual, either. Plant operators all over the country are finding Cochrane C-B Condensate Return Systems the answer to their problem of putting steam to work efficiently.

For complete details send for Publication #3250 today.

COCHRANE CORPORATION
3113 N. 17th St., Phila. 32, Pa.

The Reading Dyeing Company, Inc., operates two 250 HP boilers which supply steam at 125 psi for dye vats, drying and for plant heating in two different buildings. The diagram shows how the steam is returned from the various utilization points to the boilers through the Cochrane C-B high pressure condensate return system.



COCHRANE C-B CONDENSATE BOOSTER SYSTEM

OF HIGH PRESSURE, HIGH TEMPERATURE CONDENSATE RETURN

COCHRANE CORPORATION 85 YEARS OF SERVICE 1863 • 1948

of science are open to any investigators anywhere if they will put forth the requisite effort. However, the subject matters of the different sciences are related, and rapid advances cannot be made unless there is considerable interchange of information among scientists in this country. Moreover, undue classification and compartmentalization may mean that large groups of scientists are working needlessly on problems which have been solved by other groups. This is an obvious waste of scientific effort, and may mean a fatal delay in some particular development.

Therefore, if we adopt policies that are too restrictive about our present knowledge we stifle the growth of that knowledge. The price we have to pay in order to grow in knowledge is some giving up of present knowledge in order that we may continue to grow. From the strictly military point of view it is just as important that we get some new secrets to keep as that we hold on to the old ones. Scientific secrets deterioriate when stockpiled.

E. U. Condon, National Bureau of Standards, before the Washington Academy of Sciences, Washington, D. C., May 20, 1948.

Testing Adhesiveness

WEARING qualities of synthetic paints and varnishes can now be tested in less than a second with a new machine that utilizes the force of ultrasound.

The coating is smeared on a metal cap, which is screwed on the end of a duraluminum cylinder attached to an electronic device that generates high-frequency sound waves. When the current is turned on the cylinder vibrates violently thousands of times per second and shakes the coating loose. The force of vibration needed to make the paint or varnish peel is calculated and indicates how long the coating can be expected to last under normal conditions of wear.

The machine makes it possible for the first time to measure the degree of adhesiveness of synthetic organic paints and varnishes accurately and directly.

The caps to which the coatings are applied can be made of any metal and subjected to any aging conditions, thus enabling the tester to find out how well paints and varnishes withstand exposure to weather, corrosive chemicals, and wear. Adhesion can be evaluated in this way "within a time interval of a second."

The new method, moreover, shows great promise of providing the necessary experimental technique and tool for effective study of how and why and how much organic coatings adhere to metals, and what the subsequent effect

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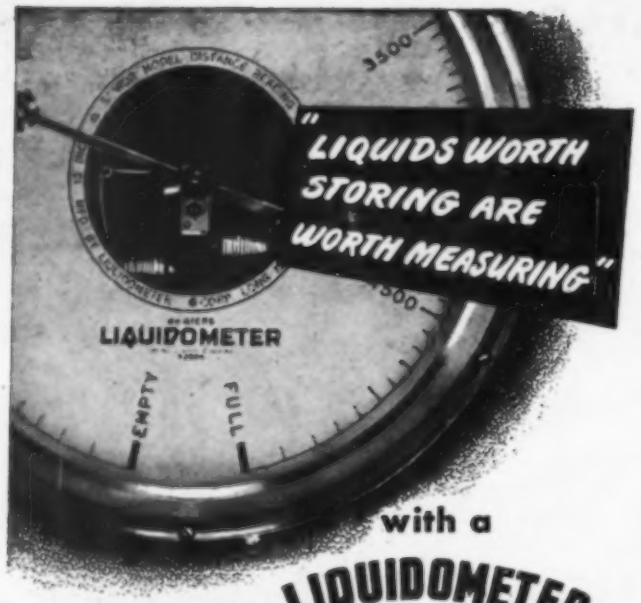

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HIGH SPEED in loading, acceleration, running, braking and unloading . . . combined with LARGEST CAPACITY in proportion to basket diameter . . . and LABOR-SAVING large bottom discharge for solids assures maximum daily output. Write for bulletin . . . It describes, in detail, these sturdy, widely used and recommended Centrifugals.

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on protection and corrosion is. Such data should prove invaluable in the formulation of better adhering and better protecting organic coating systems.

Saul Moses, Naval Research Laboratory, before the American Chemical Society, Washington, D. C., Sept. 1, 1948.

A Sidelight on Russian Chemical History

RUSSIA now has many native chemists, but none can be regarded as a successor to the great Mendelycev, who in 1869 set forth the relationships of the chemical elements in the periodic table.

Originally, the Russian Empire had no native scientists and no scientific tradition, but the Czars were intelligent enough to realize that science could do much for their country. The rulers imported scholars and scientists from Western Europe over a period of several hundred years.

These men gradually developed into a distinct caste which possessed many privileges and advantages. To preserve these privileges, they fought against the development of native Russian scientists, and for many years prevented the appearance of such workers. Their own group, continually devoted to its own interests, was recruited by new importations of western scientists.

Under these conditions, a so-called Russian science developed which did aid in the internal development of Russia's natural resources, but from which came no major contributions to world chemistry.

It was only for a brief period at the end of the nineteenth century that native Russian scientists overcame the power of the foreigners and developed a school of chemists equal to that ever developed in any country of the world.

Henry M. Leicester, College of Physicians and Surgeons of San Francisco, before the American Chemical Society, Washington, D. C., Aug. 31, 1948.

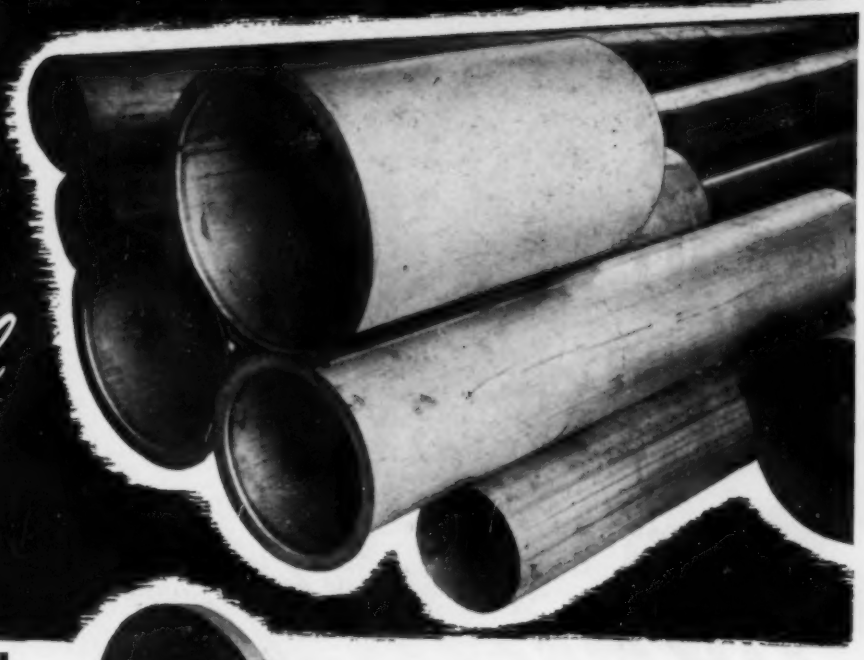
Safe Handling Of Peroxide

HYDROGEN peroxide has gained real commercial importance only in the last twenty years, and since it is an easily usable source of power, heat, and oxygen, it is finding increasing applications in the jet and rocket fields.

Thorough studies have been carried out recently by hydrogen peroxide manufacturers, shipping agencies and government bureaus to determine the nature and extent of hazards, and means of meeting them. In cooperation with the United States Bureau of Explosives, proper shipping containers have been designed. Chief danger in

Plan ahead to cut your overhead —

Investigate *Trentweld* Large Diameter *Vanstoned* Stainless Steel *Tubing*



for substantially lowered installation and maintenance of process lines

TAKE a good square look at the *engineering* and the *economics* of light-weight, thin-wall Trentweld large diameter stainless steel tubing, cold flanged at both ends at the mill for Vanstoned joints, and shipped ready for installation. Process lines like this challenge conventional piping right across the board, for while stainless does cost more as a material, it also costs far less to handle in the field. Heavy expensive rigging is eliminated, assembly work goes in record time and at a considerably lowered cost. Best of all, service life is many years longer, and repairs and replacements when they come are made in less than half the time and at only a small fraction of the cost you now accept as normal.

Trentweld engineers will be glad to study your individual problems on process lines you may have in mind — anything from 6 in. to 22 in. diameters. Tubing can be furnished plain end for flanging in your plant by your own crew. Feel free to write without obligation; and send too for the Trentweld Data Bulletin.

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the worst fires start when your plant is unprotected!

Syracuse, Indiana Trailer Mfg.
1 dead; $600,000

Fire, confined to a storeroom when discovered by the watchman, spread to stocks of paint and lumber in a large 1-story factory. A neighbor assisting firemen was trapped within the building.

Dee, Oregon Warehouse
$205,000

Flames discovered coming from the roof of a large 1-story wooden warehouse by a watchman at 3:45 A. M. spread to 1,400,000 ft. of lumber stored in the yard of a nearby sawmill.

Marion, Ohio Conveyor Mfg.
$350,000

Fire believed caused by a defective water cooler motor spread to painting material stores nearby. At 4:15 A.M., outsiders discovered the flames out of control in the large area 1-story building.

Reports of the National Fire Protection Association, month after month, show that the most costly fires start at night. The basis for this is logical; a small fire starts . . . there is no one there to spot it or to put it out . . . undetected, it grows rapidly . . . then the watchman, or often a passerby, discovers it . . . too late.

The new C-O-TWO Combination Smoke Detecting and Fire Extinguishing System is a 24 hour a day automatic fire watchman. It provides the fastest type of fire protection known. The first whiff of smoke in a protected area sounds an alarm. Then fast, clean, non-damaging carbon dioxide blankets the fire, putting it out in seconds, before it spreads and causes extensive damage. C-O-TWO is safe as well as highly effective on flammable liquid and electrical equipment fires.

Be sure that your flammable liquid hazards, electrical equipment, record and storage vaults . . . all of your fire hazards are completely protected 24 hours a day. Let an expert C-O-TWO Fire Protection Engineer advise you on your fire protection needs now before fire strikes. Write today . . . tomorrow may be too late.

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handling concentrated hydrogen peroxide lies in its most valuable quality, its ability to generate large volumes of water vapor and oxygen at high temperatures.

Investigations have shown conclusively that if concentrated hydrogen peroxide is correctly handled there is no more danger associated with the product than with many other commercial chemicals now in use.

Frederick A. Gilbert, Buffalo Electro-Chemical Co., before the American Chemical Society, Syracuse, N. Y., June 28, 1948.

Isotopic Warning

PITFALLS and traps await the unwary scientist who plunges into research with radioactive isotopes without fully understanding their peculiar habits.

In the past decade there has been remarkable progress in the application of radioactive isotopes to analytical problems of all kinds, physical, chemical and biological. The recent very rapid advances in the field have attracted a large number of new investigators, and mistakes made ten years ago are being repeated on a larger scale today.

The great usefulness of a radioactive isotope of a particular element is that its physical and chemical behavior is essentially the same as that of the natural mixture of stable isotopes. The fact that this identity may or may not be complete needs to be remembered.

In many situations, radioactive isotopes of an element behave as true tracers for the atoms of the element in question; that is, they are spies which are undetectable until they betray themselves by disintegration. In other cases the radioisotopes act as near-tracers, or tagged atoms, which differ slightly from normal atoms in their properties, but which usually go along with the mob.

These slightly different degrees of behavior are often important, and it should be noted that the differences may be quite large, for the same isotope may behave as a good spy in one reaction, a tagged atom in another, and, if conditions are peculiarly adverse, may behave almost like a different element.

Peter E. Yankwich, University of California, before the American Chemical Society, Chicago, Aug. 13, 1948.

Engineering's Opportunity

BASICALLY, the world recovery program is aimed at enhancing the standard of living in a large segment of the world which never had enjoyed the blessings we here in the United States are inclined to take for granted. The program's soundness is attested historically by the fact that well-fed na-

TANTALUM HEATERS ARE *Economical!*

as well as practical and dependable

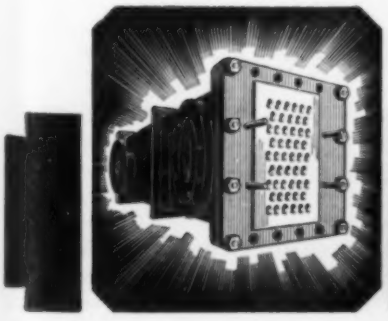
LET THE RECORDS SPEAK

The tantalum heater illustrated is one of ten, bought in 1939 to heat large tanks of muriatic acid. These heaters returned their investment in ten months in savings. Their overall cost for eight years was *less than one-sixth* that of a "corrosion-resisting" alloy.

Performance records throughout the world show that tantalum heaters, evaporators, coolers, condensers, distillation units and HCl plants are economical. Why not consult with Fansteel and find out how easily and economically your corrosion problem can be solved? Fansteel Metallurgical Corporation, North Chicago, Illinois.

USE TANTALUM WITH ECONOMY

For most acid solutions and corrosive gases or vapors, except HF, alkalis, or substances containing free SO_3



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tions are not nearly so inclined to war as the underfed countries.

Since the engineering profession is the one which played such a vital role in bringing about our high American standard of living, it is logical that it should be called upon now to contribute to the well being of the peoples we are endeavoring to assist under the Economic Cooperation Administration.

Moreover, the engineer can do the enormous job called for under this program with the full confidence and respect which American technological superiority has won throughout the world. The engineering profession stands ready to perform, in peace as it did in war.

By planned utilization of the resources represented by the engineering profession, we can make the world recovery program a matter not merely of dollar assistance, but an instrument for pointing the way to the surest road to peace and, at the same time, invoke the best way to assure American taxpayers of their money's worth in this gigantic undertaking to avert a war which would all but destroy civilization.

Col. W. N. Carey, before the American Society of Civil Engineers, Seattle, Wash., July 22, 1948.

Proof Positive

FIRST positive proof of the existence of chemical element 43 has been obtained through atomic research at Oak Ridge, Tenn. For the last century this element, for which the name technitium is now proposed, has been one of the mysterious members of the whole family of elements.

Since 1846 numerous claims to the discovery of element 43 have been made, and such names as ilmenium, davyum, lucium, and nipponium have been suggested. None of the claims stood up under subsequent investigation, however, and the number 43 remained just a gap in the periodic table. Then in 1925, two scientists reported the finding of both element 43 and element 75 which, they had reasoned, would be found together in nature. They presented evidence which caused the general acceptance of the names masurium and rhenium for elements 43 and 75.

Since their announcement, rhenium has become an item of considerable commercial importance, the largest United States producer probably being the University of Tennessee. The claims on masurium were not confirmed by production of weighable amounts.

The next major step toward the isolation and characterization of element 43 was taken when Segre and co-

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In 30 years of engineering and building complete plants in every field of industry, we have also designed and built hundreds of power plants and steam plants of every known type. Some are as small as 50 B.H.P.; others as large as 33,000 B.H.P. Most burn the common fuels—coal, gas, or oil—but others are designed to burn wood bark, refuse wood, coke breeze, coke oven gas, black liquor and other refuse fuels, and involve the complex problems of storing and handling these unusual fuels. Some, designed for out-of-the-way places, are so simple they can be operated by inexperienced help. Others, such as those designed for large utility companies, are highly complex, greatly instrumentalized, and almost fully automatic.

This long and versatile experience has equipped the Ferguson organization unusually well to solve the problems of process steam and power generation, either as part of an over-all project, or as a separate undertaking.

Why not call, wire, or write our nearest office? We will be happy to submit our preliminary proposals, based on our method of delivering a ready-to-operate plant under one contract and one responsibility.

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workers published in the late 1930's their observations on samples of the element molybdenum, number 42, which has been bombarded with neutrons in the cyclotron. In addition to recognizing some radioactive isotopes of element 43, they were able to note several of its chemical properties, and in October 1946, Dr. Segre proposed the name technetium, with the symbol Tc.

With the advent of the Manhattan District and corresponding advances in the understanding of nuclear phenomena, it became apparent that technetium could be isolated in weighable amounts.

By September 1946, G. E. Boyd and several co-workers could report success and, in addition, the amounts isolated enabled them to observe several of the physical and chemical properties of the element. About the same time a process was invented which effectively separates from uranium and the fission products those elements which form acid-insoluble sulphides, and the process was first used to isolate several milligrams of the new element.

G. W. Parker, James Reed, and J. W. Ruch, Oak Ridge National Laboratory, before the American Chemical Society, Syracuse, N. Y., June 30, 1948.

Nutritional Equivalence of Proteins and Components

MANY of the properties of a protein molecule result from the characteristic properties of the individual units (amino acids) of which it is composed. Therefore, many aspects of the physical, chemical, physiological, nutritional, and other behaviour of proteins must be explained in terms of their component amino acids.

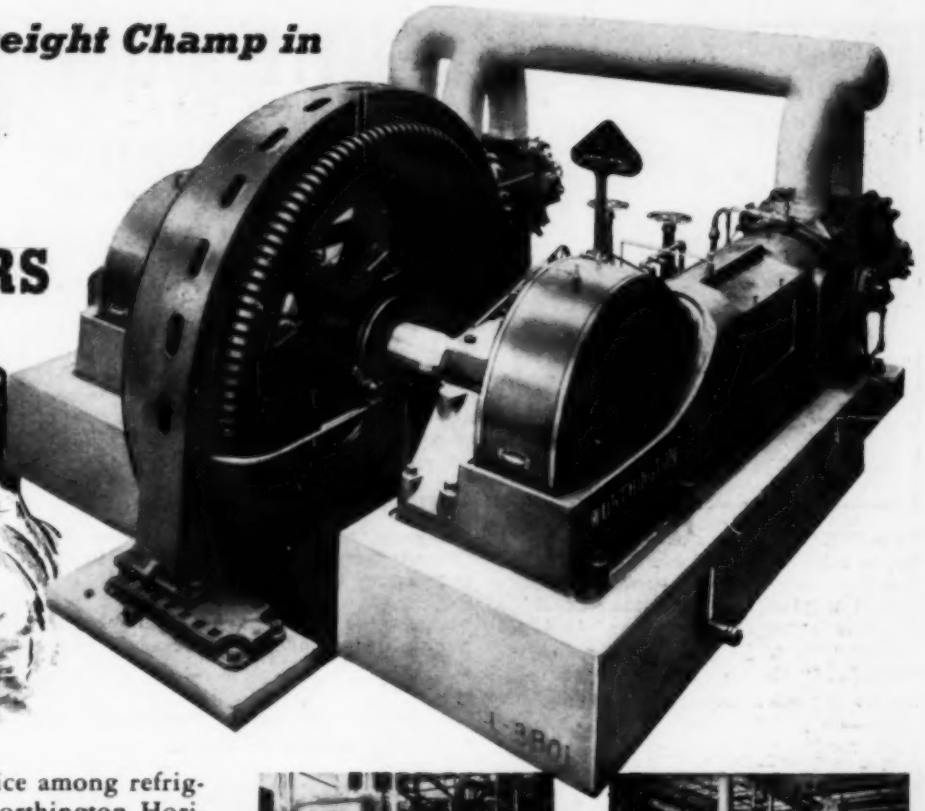
Much work has been done and much information is available on the metabolism of both proteins and amino acids and their role in the nutrition of animals and plants. We know that a certain amount of protein is essential to the life of animals. We know that certain amino acids are essential while others are not. We know that the nutritional quality of proteins varies, depending largely upon their amino acid composition. However, one of the most fundamental basic questions has, as yet, not been answered experimentally: Is the nutritional effect of a protein the same as that of its component amino acids, qualitatively as well as quantitatively?

It is only in recent years that it has been possible to put this important question to a quantitative test.

In our experiments weanling mice were used. The mice were fed a diet which contained either 15 percent of crystalline beta-lactoglobulin or a cor-

Here's the Heavyweight Champ in

HORIZONTAL DUPLEX COMPRESSORS



For heavy-duty work, first choice among refrigeration compressors is the Worthington Horizontal Double-Acting Compressor.

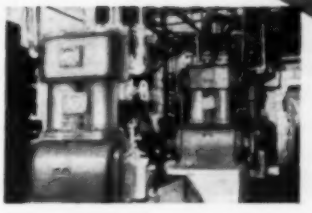
There's *solid punch* in the machinery-steel piston rods operating in special alloyed semi-steel cylinders with full-size suction and discharge openings, large refrigerant-gas passages and liberal valve area.

There's *sure-footedness* in the cast-iron frame, with base extending full length to minimize cylinder overhang and give maximum bearing on foundation.

There's *staying-power* in the open-hearth steel-forged crankshaft . . . counterbalanced crank pressed onto shaft and securely keyed . . . heat treated and hardened crank pins . . . marine-type connecting rods.

And there's *trouble-protection* in the exceptionally deep stuffing boxes with metallic full-floating packing . . . babbitt-lined steel bearings centrifugally cast in steel . . . full pressure-type lubrication on large sizes, flood type on smaller.

For further proof that *there's more worth in Worthington,* see your nearby Worthington distributor, or write for Bulletin C-1100-B20 to Worthington Pump and Machinery Corporation, Harrison, N. J. *Specialists in air conditioning and refrigeration machinery for more than 50 years.*



WORTHINGTON IN WORLD'S LARGEST ORANGE JUICE PROCESSING AND CONCENTRATING PLANT

At the Dunedin, Fla. plant of Juice Industries—reputedly the largest of its type in the world—Worthington has installed:

LEFT—Three vertical ammonia compressors to cool two large storage rooms—one where frozen concentrated orange juice is kept at zero degrees, the other for standard concentrated juice at 35F. Both rooms are 80 by 80 by 20 ft high; the former has 12 in. of insulation, the latter 6 in.

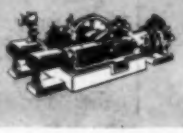
RIGHT—Horizontal ammonia compressor for quick-freezing the concentrated juice at minus 20F. Quick-freezing of the juice (while packed in cans) seals in the vitamin content which would dissipate if stored for long at moderate temperatures.

WORTHINGTON

AB-37

FIVE MORE REASONS WHY WORTHINGTON LEADS IN INDUSTRIAL REFRIGERATION

Horizontal compressors for all types of refrigerants



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responding amount of a mixture of its component natural amino acids; the rest of the diet was made up of fat, carbohydrate, and all the necessary minerals and vitamins.

The results were clear-cut. Over a four-week experimental period, the mice on both these diets gained an equal amount of weight. The experiments thus establish quantitatively the nutritional equivalence of a protein and its component amino acids. This will have to be verified for animals of other species and extended over longer periods of time.

The results are of fundamental importance for protein chemistry, protein metabolism and protein nutrition. They constitute fundamental progress; they establish a base line from which other and future research will take its cue.

Erwin Brand, Columbia University, and David K. Bosshardt, Sharp and Dohme, before American Chemical Society, Washington, D. C., Sept. 1, 1948.

Perfect Examples of Over-Specialization

MINING, ceramic, petroleum, automotive, and aeronautical engineering are perfect examples of what the undergraduate should never take, even to satisfy a morbid curiosity. They do not exist as separate engineering subjects. They were created by those who wished to have a separate curriculum of their own to satisfy the mistaken desire of some ignorant student or to please an equally ignorant employer, who believed such a specialized curriculum would produce a graduate more fitted to his industry and who would work for less than the boy well trained in the fundamentals.

Donald B. Keyes, Heyden Chemical Corp., before the American Chemical Society, Washington, D. C., Aug. 31, 1948.

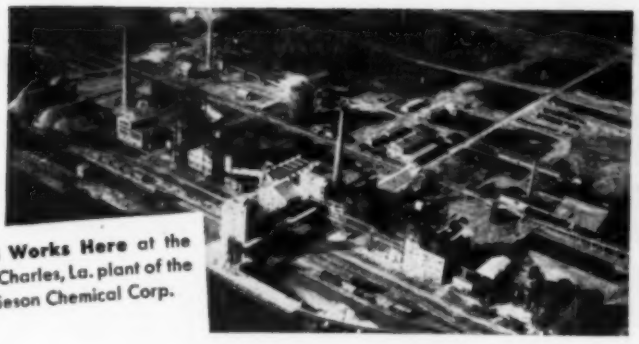
Plasticizers Make Plastics

PRODUCTION of plasticizers is heading for an all-time high of 200 million pounds this year.

This development is a corollary of the tremendous expansion of the plastics market since the war. The type of plasticizer employed is primarily responsible for the specific properties of various plastics, such as heat stability, oil resistance, and flexibility at low temperature.

Through the judicious use of mixtures of plasticizers, it has become possible to correct individual product deficiencies. The art of such mixtures is only now developing but very definite progress has been noted.

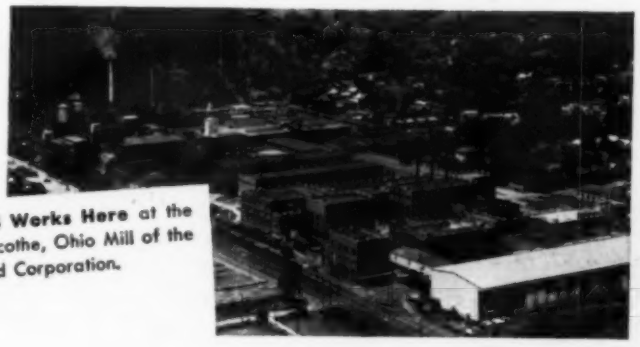
One of the reasons for the rapid advance in plasticizer developments is the close technical relationship be-



4+8 Works Here at the Lake Charles, La. plant of the Mathieson Chemical Corp.

4+8 Works Here at the Kodak Park plant of Eastman Kodak Co., Rochester, N.Y.

alkali OR FILMS



4+8 Works Here at the Chillicothe, Ohio Mill of the Mead Corporation.

4+8 Works Here at the Midland, Michigan plant of The Dow Chemical Company.

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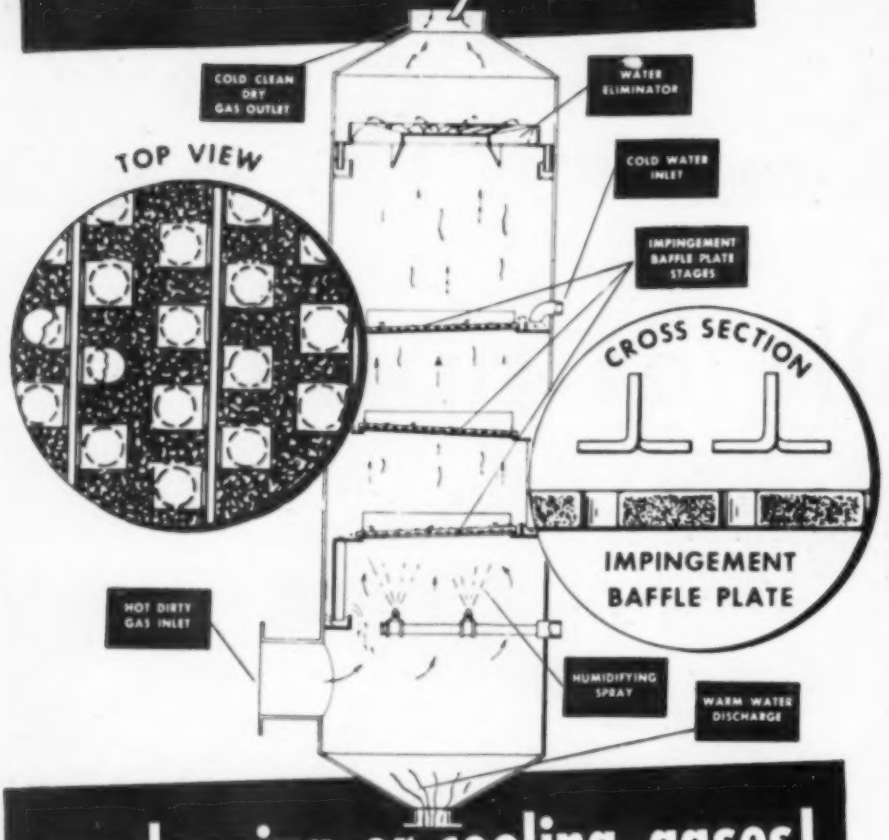

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PEABODY Scrubbers, Coolers, and Absorbers have solved many varied problems in a wide range of industries requiring more efficient gas-flow processing and better control of process variables. Typical problems that have been economically solved by Peabody for many leaders in the alkali industry alone, involved gas cleaning from both rotary and vertical lime kilns, dolomite kilns, and ash dryers. Because each problem is different, each Peabody unit is *engineered to job specifications.* You can depend on Peabody experience and engineering to get you maximum efficiency on any gas-cleaning or gas-cooling problem.

Complete details and further information available without obligation. Write for Bulletin 203.

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tween user and supplier. The old tendency to put products into general bins of stated character is slowly disappearing. More and more, the suppliers are recognizing the specificity of each type of product made.

W. A. Woodcock, Carbide and Carbon Chemicals Corp., before the American Chemical Society, Washington, D. C., Aug. 31, 1948.

Blueprinting Protection

ELECTRICALLY charged sandwiches are helping to develop completely waterproof paints.

Paint and varnish coatings usually break down when moisture penetrates and undermines them, a new method reveals flaws and pores as tiny as a pin point. Paper soaked with a salt solution is sandwiched between a plate of aluminum and another of iron, which has been painted, and then the metal plates are connected to opposite poles of a battery.

If the paint surface is not impervious to water, the salt solution seeps through and with the aid of the electric current floats away tiny specks of iron, depositing them on the wet paper. The paper is removed and treated with a mixture of potassium ferrocyanide and potassium ferricyanide, which combine with the iron and form a vivid blue color.

In addition to revealing whether the paint is waterproof, the test gives a permanent map showing the size, shape, and location of every flaw. By making the test before and after the coating has been exposed to salt atmosphere, ultraviolet light, or other destructive elements, it is possible to evaluate the coating.

A set of prints, together with a 48-hr. salt-fog exposure and a repeated set of prints, gives concrete data for evaluating and comparing paint modifications and treatments. The method has also been used successfully in detecting mechanical damage to a coating and the amount of subsequent spreading of moisture under the coating from the damaged area.

Max Kronstein and Marion M. Ward, New York University College of Engineering, before the American Chemical Society, Washington, D. C., Sept. 1, 1948.

Aluminum Shortage Will Grow Worse

IN SPITE of the large amount of scrap available after the war and the use of the stockpile, indications are that the aluminum shortage will increase. This year the demand for aluminum for peacetime use exclusively will be short 275,000 tons, and by 1952 the shortage will reach 375,000 tons. To meet this shortage, it would

Here is the CMH answer to expansion joint leakage problems

Right, Above—CMH Free-Flexing Expansion Joint

Right, Below—CMH Controlled-Flexing Expansion Joint

Wherever expansion joint leakage is a problem (*and it should not be*) CMH FLEXONICALLY* engineered expansion joints offer the maintenance-saving answer. CMH Expansion Joints cannot leak! They are the practical, dependable way to absorb expansion and correct misalignment.

Available in stainless steel or copper and in free-flexing and controlled-flexing types they are suitable for original installations or for replacement of antiquated means of expansion control. Sizes range from 4" to 24" inside diameters, with flanged or welding ends to suit connected piping requirements. Conservatively rated for pressures up to 300 p.s.i., and temperatures to 900°F.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

*the science of FLEXONICS..."the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion"...is exemplified in the basic products of Chicago Metal Hose Corporation.

CMH engineered applications are your best assurance of getting the right expansion joint for the job. Write for additional information and ask for a copy of Expansion Joint Bulletin, EJ-47.

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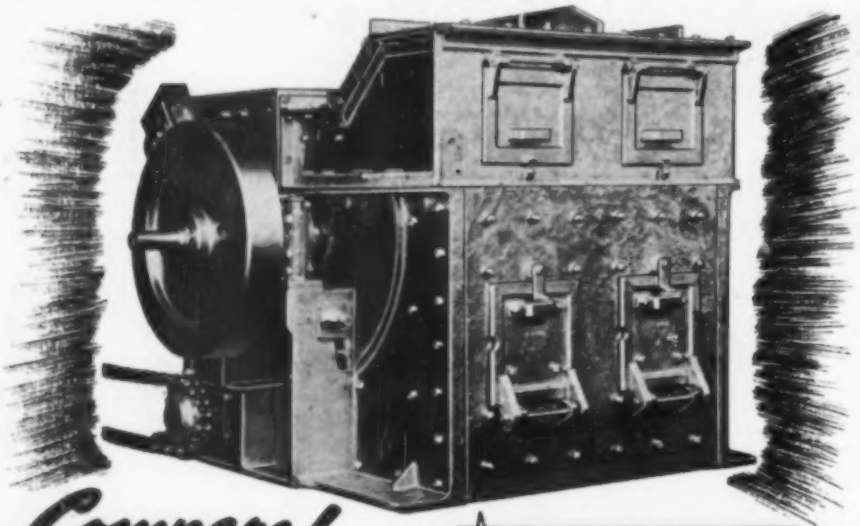
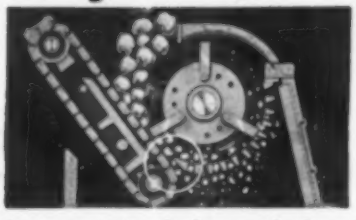
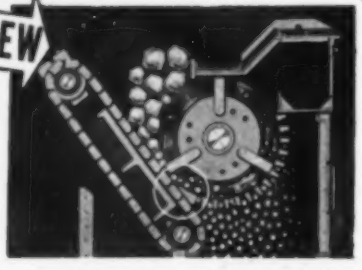


Compare!





Note by comparing *before and after* diagrams, above, how the new, Extended Moving Breaker Plate guards against the passage of oversize material between breaker plate and front cage bar—also how added space between cage bars and back of mill assures unrestricted flow of material.

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take 550,000 kw. of power capacity now and a total of 750,000 kw. by 1952.

This estimate does not include the aluminum necessary to build and maintain the 70-group air force, nor any increased military demands. Assuming that it takes five years to build, this air force will require after 1953 about 100,000 additional tons of aluminum annually just to maintain and replace it. To provide the power necessary by 1953 to maintain the 70-group air force and the related Navy air force will require an additional 200,000 kw. of prime power capacity.

An additional primary aluminum capacity, above that existing in 1948, of between one million and two million tons will be required by 1960 to meet the estimated demand. Between two million and four million additional kw. of power capacity will have to be built to provide the necessary power.

It is expected that the government will have to supply most of the additional power requirements. At present the TVA and the Bonneville Power Administration are supplying 70 percent of the power consumed by the aluminum industry.

Paul J. Raver, Bonneville Power Administrator, before The American Society of Mechanical Engineers, Portland, Ore., Sept. 7, 1948.

Patent Rights for Financial Aid

AVERAGE chemical engineering departments tend to cut unit process laboratory work to a minimum. This is due, no doubt, to the expense incurred by the consumption of rather expensive chemical raw materials. In the unit operations much of the chemical raw material may be recovered and used year after year with only small quantities of make-up required. In the unit process laboratory, on the other hand, all of the raw material needed is invariably consumed, or at least its chemical nature so altered, as to have little further value to the department.

If each graduate student is to produce individually an acceptable thesis, we must budget $500-$900 for his equipment and supplies. If every qualified applicant is to be accommodated, the departmental budgets for graduate student research will have to be very large. Where many departmental budgets are already taxed to the limit to meet the salary requirements of its permanent staff, something else has to be sacrificed and it is often graduate research. Yet no other phase of departmental activity adds so much to its prestige, reputation, and general well-being as the thesis accomplishments of

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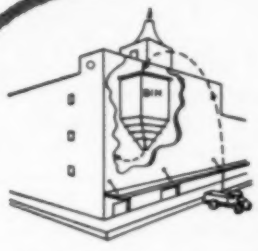
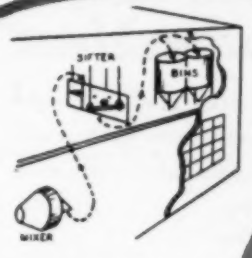
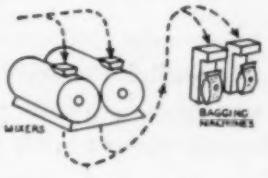


Lifting bulk chemicals from truck to storage bin.



Moving pulverized material from mixer to sifter to storage bins without spillage.



Carrying bulk material from mixers to bagging machines, cleanly and without spillage.

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S-A engineers can frankly suggest the best system for your specific need, because they don't have to solve every problem with one type of equipment. They have the *complete* S-A line of belt conveyors, bucket elevators, Redlers, skip hoists and other equipment to choose from. Ask us to show how we can help you, *today!*

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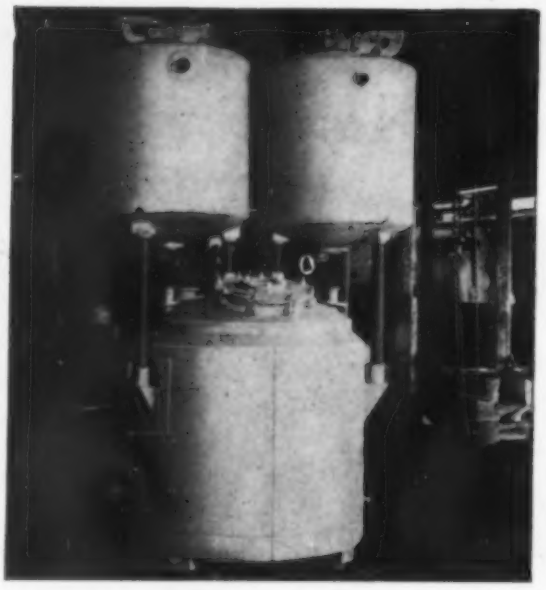

Above: Jacketed and insulated pressure tanks, fabricated from Hastelloy C, with stainless steel sheathing.

The Link Between Plans and Production

Before new products and new processes can be turned into profitable realities, there is frequently need for vessels and processing units which are not obtainable from usual supply sources in the chemical industry.

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We will work directly from blueprints already in existence, or will have our engineering department work with you in developing specifications. Write, wire or phone—we'll be glad to discuss your problems, without obligation.

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the graduate program. One obvious answer to this dilemma is support of the graduate program by industry.

Industry is established fundamentally to make a profit. Most industries are so set up that they can justify to their owners and stockholders the support of only that college research which stands a reasonable chance of yielding some profit. In return for financial support, industry usually demands exclusive patent rights to all discoveries resulting from the program. Industry is generally aware of the need of their financial assistance in turning out in sufficient numbers the properly trained scientists and engineers that are so urgently needed. Nevertheless, very few industrial organizations are able to render this assistance on a philanthropic basis. The arrangement of exchanging patent rights for financial aid to graduate research appears to be the most mutually satisfactory. Colleges and universities are in the business of training students; industry is in the business of obtaining, developing, and exploiting patents.

Research and development work in the field of unit processes yields results having a high degree of patentability. Many subjects in this field are of great interest to a large variety of chemical and petroleum industry. These industries are more likely, therefore, to give direct financial support to unit process research in the colleges, thus enabling them to contribute to the cost of training future scientists and engineers while at the same time receiving something of immediate value.

Lloyd Berg, Montana State College, before Third Summer School for Teachers of Chemical Engineering, Madison, Wis., Aug. 30, 1948.

Sintered Catalyst

Silver gauze catalysts are employed for converting methanol to formaldehyde in the presence of air. When operating in atmospheres containing about 12 percent oxygen and at about 500 deg. C. the gauze becomes fouled rapidly and increasingly greater pressures are required to maintain production. A minor part of the fouling is due to the accumulation of foreign particles and carbon in the catalyst mass. The major portion of the fouling is due to sintering of the wire surface, which results in a spongy silver layer being formed on the wire surface. This decreases the effective pore diameter.

Experimental work has indicated that the sintering takes place only in the presence of oxygen; it is greatly accelerated by the presence of water vapor and fluctuating temperatures. Used catalysts and experimental speci-

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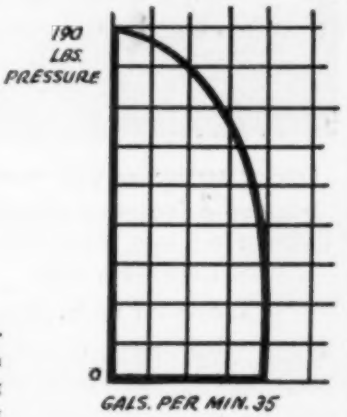
3. *Easy to inspect.* Entire pump can be disassembled without disturbing suction or discharge connections.

IN COST

Initial cost is low—and lower still when you consider quality construction and the many operating advantages.

RANGE



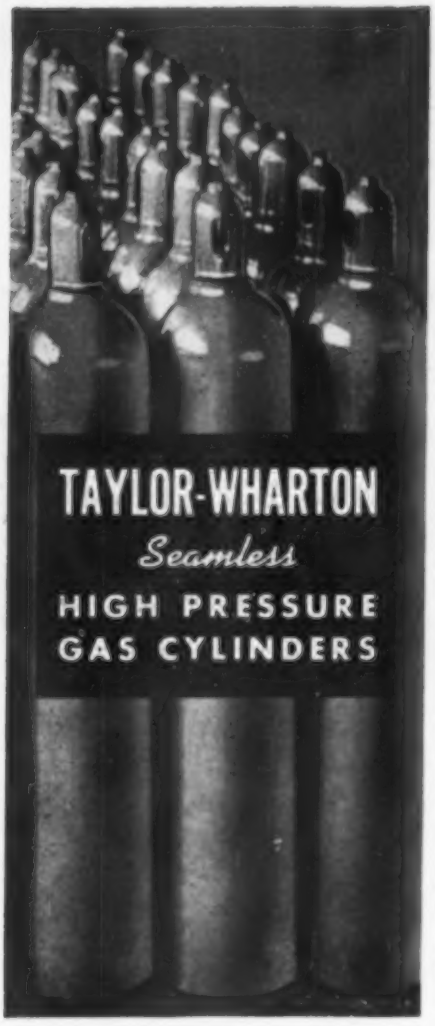
Nine Sizes, ¼ HP to 5 HP
Capacities: to 35 GPM
Pressures: to 190 lbs.

GOULDS

Write Goulds Pumps, Inc., Seneca Falls, N. Y., for complete information on this new pump. Ask for bulletin 630-A1.

PUMPS, INC.

the PUMP FOR the JOB



Prompt service on your needs for

CHLORINE, OXYGEN, HYDROGEN, CARBON DIOXIDE, NITROUS OXIDE, NITROGEN, ETC.

Diameters up to 13"

• All Taylor-Wharton cylinders are made by the reliable "billet" process to the highest standards of manufacturing, testing and inspecting. Bottoms are integral (not spun), wall thicknesses are carefully controlled for uniformity. Complete, modern facilities to meet all your needs as to quantity, types and sizes. Let us quote on your requirements.

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IRON & STEEL COMPANY

Cylinder Sales Office:
110 E. 42 St., New York 17, N. Y.

HIGH BRIDGE, N. J. & EASTON, PA.
Cable: TISCOSTEEL,
Washington, New Jersey, U. S. A.

mens show that the sintering originates along the crystal boundaries near the surface of the wire and is primarily a result of solution and evolution of oxygen at the crystal faces.

R. L. Brewster, the Borden Co., before Division of Colloid Chemistry, American Chemical Society, Portland, Sept. 13, 1948.

Employment Opportunities

EMPLOYMENT opportunities for chemists may be classified according to the principal functions of industrial chemical companies—research, development, production, and sales.

Opportunities exist today in both fundamental and applied research activities. Advanced training in chemistry is recommended for positions in fundamental research. Applied research may appeal to graduates at all levels of college training, although advanced study is beneficial. Development which makes useful the ideas of research also provides employment opportunities for chemists, particularly if they are also trained in engineering.

Many chemists find employment in the actual manufacturing of chemical products. Quality standards must be maintained for raw materials and finished products and many of the plant operations are supervised by technically trained men. Young men with sales inclinations will find opportunities in either technical sales or direct selling. Employment in sales is usually preceded by a period of training in either the plant or the laboratory.

Continued employment opportunities for well-trained chemists appear to be assured during the present expansion of the chemical industry.

J. W. Reynard, E. I. du Pont de Nemours & Co., before Division of Chemical Education, American Chemical Society, Washington, Aug. 31, 1948.

Team for Two

CHEMICAL marketing research, undoubtedly the most technical of the varied fields of marketing, requires unusual qualifications on the part of those who undertake it. It requires a broad chemical education and experience, and a precise knowledge of industrial (rather than consumer) marketing research techniques, as well as a complete working knowledge of industrial marketing practices.

Not too many years ago, the average chemical manufacturer had little need for marketing research, since a large percentage of chemical products reached the market through selling agents. Today, however, many companies are manufacturing proprietary items as well as servicing accounts of actual users. This is a new field of distribution. Chemical industries had to approach this problem with the only

Smilin' Tex says:

"IT AIN'T BRAGGIN' IF YOU CAN PROVE IT"

If you ever drink the water of the Texas Coast country we'll lay money you'll come back

That's an old expression down here in Texas. Reason it came to be was because all the drinking water was so pure and good that every town thought it had the best.

And there will never be a shortage of industrial water because the rivers that flow across the coastal plains of Texas afford a more than adequate source.

But plenty of water is but one reason why you should locate, relocate or expand your chemical plant to the Texas Gulf Coast.

Here are some more "come-on" reasons: down here there is a superabundance of sulphur, salt and hydrocarbons — the basic materials upon which the chemical industry thrives.

Natural gas is the cleanest, most economical fuel and Texas has 58% of the U. S. known reserve.

Unexcelled transportation facilities — land, water, air; no sales tax, no State income tax; cooperative, intelligent labor; sunshine; plenty of room for factory and home.

For a new chemical site, the Texas Gulf Coast is your best bet.

Send for a Survey of the Texas Coast country. On request, we will prepare for your company a carefully engineered and confidential survey of the Texas Coast Country individualized to fit your particular problem. No cost, no obligation. Address Research Department, Houston Pipe Line Co., Houston, Texas.

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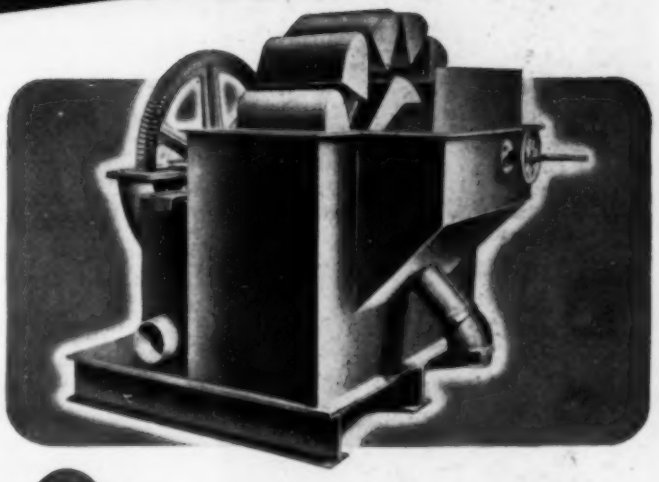
Wholesalers of **Natural GAS**

Complete Uniformity is "Run-of-the-Mill"

when you use TRAYLOR FEEDERS

Traylor offers two types of feeders to give mill operators complete control of either wet or dry feed with consequent uniformity of product size. Unless rate of feed to mills is carefully controlled, product size varies, becoming finer with slow feed . . . coarser when fed faster. Manufacturers of Portland cement and other products demanding rigid control of particle size are using Traylor feeders with consistent success.



TRAYLOR SLURRY FEEDER — A fully enclosed, self contained ferris-wheel type feeder. Supplies controlled feed of wet materials to rotary kilns and mills. Husky welded steel plate construction with hinged inspection door and clean out port. Heavy welded base plate provides support for motor and worm gear housing. Can also be driven by chain from kiln through a counter-shaft. Discharge rate is easily controlled by an adjusting wheel on the outside of housing. Built in sizes 3′ to 6′.

TRAYLOR TABLE FEEDER — This feeder provides close control of free flowing materials, both dry and moist. Easy adjustment changes rate of feed to mill, kiln or dryer. Table, supported on taper roller bearings, is turned by a worm with ball thrust bearings. All gears operate in oil in a dust proof chamber. Multiple installation will feed several materials in different proportions to the same machine. Built in sizes from 2′ to 6′.

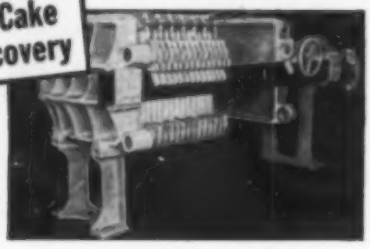
Illustrated Bulletin 114 contains installation pictures and complete details on all types of Traylor feeders. Write for your free copy today.

TRAYLOR ENGINEERING & MANUFACTURING CO.
101 Mill Street, Allentown, Pa.

TRAYLOR *Table and Slurry Feeders*

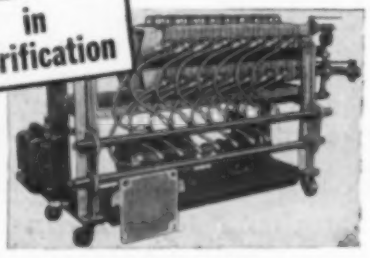
SHRIVER
Filter Presses
are Designed for
LOWER COST OPERATION

in Cake Recovery



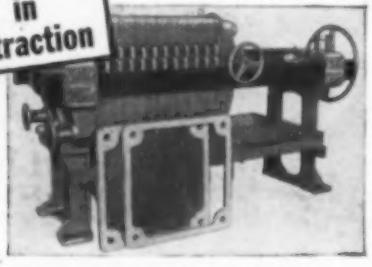
They produce filter cakes of any size, thickness and number, built up at any required pressure; firm, and dry enough to process or dry in subsequent equipment.

in Clarification



They produce in any desired volume at any flow rate, liquids of crystal clarity and purity, at any temperature or pressure, regardless of viscosity, thickness or color of slurry.

in Extraction



They produce filter cake that can be partially or thoroughly washed, steamed, extracted, leached, redissolved or melted right in the filter press.

Shriver Filter Presses are built of any material to process 1,000 gallons of slurry, for any pressure to 1,000 p.s.i., using any filter medium. Match that kind of design and performance versatility with any other kind of processing equipment, if you can.

Write for Complete Catalog
T. SHRIVER & COMPANY, Inc.
802 HAMILTON ST., HARRISON, N. J.

type of personnel available—technical men. Some companies have been fortunate enough to find men sufficiently flexible to adapt themselves to their new tasks—but as a whole, management has failed to recognize the need for an adequate job.

It has been our experience during five years of study in the chemical field, that while technical chemical advice is needed in planning marketing research projects, in pilot studies, or in analysis and in drawing conclusions, —it should be used only as an aid to the program, not to direct it. We must not allow technical advice and detail to overshadow results, because we are studying marketing function,— a social science, not a physical science.

At first we felt that technical men were not needed except in, and as an aid to, the preparation of the interviewing manual and in the interpretation of the findings. The results, though reasonably satisfactory, left much to be desired. Next, we took technical men,—gave them a few weeks training in marketing, and then assigned them to actual projects. The dearth of marketing information they produced was discouraging.

As a result of these early experiments, we devised the techniques we now use—the marketing man and the technician as a team. Together they make the first call in each industry and perhaps a second, or until we are satisfied that the marketing man can complete the industry alone. Fortunately, we have our own chemical testing laboratory which keeps our chemical staff close to the field and available at all times.

Warren C. Hyer, York Research Corp. of Connecticut, before Division of Industrial and Engineering Chemistry, American Chemical Society, Washington, Aug. 31, 1948.

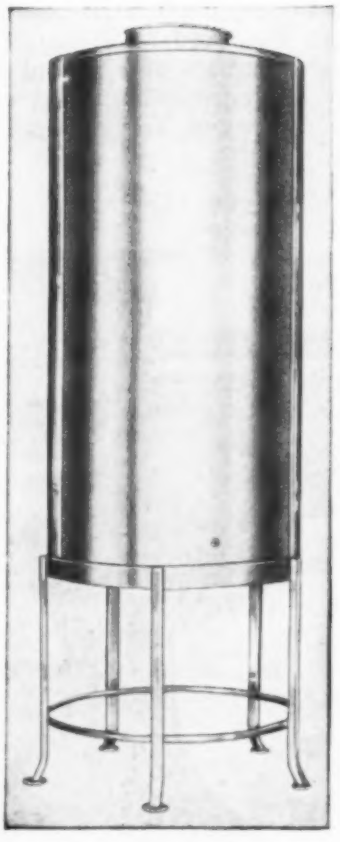
Renewable Source of Organic Chemicals

VARIOUS wood-using industries have in their hands the raw materials for the production and the synthesis of a great number of pure organic chemicals useful in all walks of life. Many of these products are wasted at the present time, but fundamental research in these fields is uncovering new products and novel uses for the byproducts of the wood-using industries.

Wood has one great advantage over coal and petroleum as a source of organic chemicals because, of the three, it is the only one that can be replenished in a relatively short time. Therefore, the day is not far off when wood will be one of the chief sources of organic chemicals.

In addition to the well known

THEISEN
Stainless Steel Storage Tanks



Capacities 250, 500 & 1000 Gallons

METAL PRODUCTS CORPORATION

Est. 1923

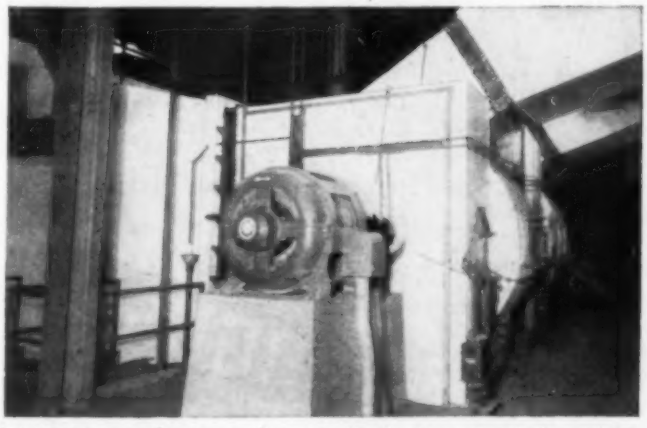
50 W. 19th St., Weehawken, N. J.

KAYLO LIGHT DENSITY HEAT INSULATING BLOCK

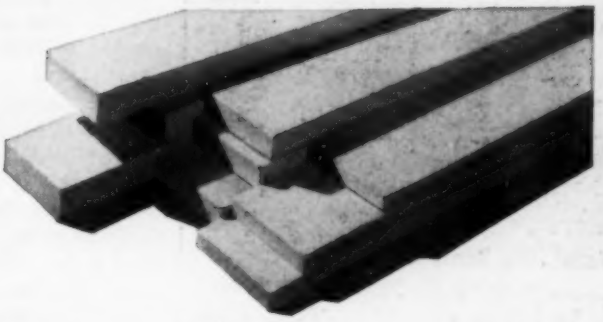
PHYSICAL CHARACTERISTICS

DENSITY	Approximately 11 lb. per cu. ft.
FLEXURAL STRENGTH	Approximately 50 lb. per sq. in.
COMPRESSIVE STRENGTH (at 5% deformation)	
Before heating	150 lb. per sq. in.
After heating for 24 hours at 1200° F.	117 lb. per sq. in.
LOSS IN WEIGHT	
After boiling for 24 hours (after drying)	0.2%
RESISTANCE TO ABRASION (Conventional tumbling test-loss in weight after 10 minutes)	
After heating for 24 hours at 1200° F.	6.9%
DIMENSIONAL STABILITY	
Linear shrinkage after heating for 24 hours at 1200° F.	1.5%
MOISTURE ABSORPTION (volume)	
After 6 hours exposure in atmosphere of 120° F. and 90% Relative Humidity	0.9%
CONDUCTIVITY (K)	
At 100° F. mean temperature	0.41
At 500° F. mean temperature	0.54

CLEAN, straight edges on these precipitator hoppers because they're insulated with Kaylo Heat Insulating Block. This material is easy to work with because it's easy to cut, yet has high flexural strength.



IN THIS power house equipment, Kaylo Heat Insulating Block covers both flat and curved surfaces. It minimizes heat loss, thereby saving fuel and keeping room temperatures at comfortable levels.



Now ready

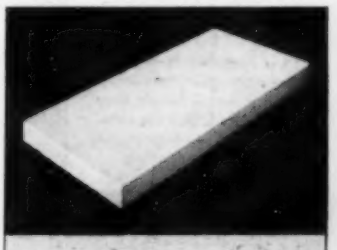
for maintenance problems

KAYLO Heat Insulating Block (density: app. 11 lb. per cu. ft.) is now available for maintenance and new construction where a strong, lightweight insulation of high efficiency is needed.

Made in standard sizes (36 inches long, 6 or 12 inches wide and from one to three inches thick), it is efficient throughout the range of temperatures encountered in most plants. It has a "k" of approximately 0.48 at 300 mean and 0.54 at 500 mean; its curve is relatively flat. It can be used in temperatures up to 1200° F. Light in color, light in weight, smooth, strong, easy to handle and apply, it finishes to make clean-cut, good looking jobs requiring exceptionally low maintenance.

Thoroughly Tested in Service

Kaylo Heat Insulating Block has been in pilot plant manufacture for several years, and many hundreds of thousands of square feet of it are now in use on typical heat insulating applications — in central power plants, chemical plants, textile mills, food processing plants, paper mills, steel mills, glass plants —on refinery equipment, ships, locomotives, annealing lehrs, high pressure boilers, hot air ducts, breachings and many other uses.



KAYLO®
Heat Insulating Block
AMERICAN STRUCTURAL PRODUCTS COMPANY
Subsidiary of
OWENS-ILLINOIS GLASS COMPANY

Now in production in a new manufacturing plant, Kaylo Heat Insulating Block is being shipped in quantity for the first time.

SEND COUPON FOR TECHNICAL DATA AND SAMPLE.

AMERICAN STRUCTURAL PRODUCTS COMPANY
Dept. E-453, P.O. Box 1035
Toledo 1, Ohio

Gentlemen:

Please send me: ☐ Free illustrated booklet "Kaylo Heat Insulating Block."

☐ Free sample of Kaylo Heat Insulating Block.

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The Low Cost Watchman that may save you 100 times its price!

New . . . Powerful ALNICO PLATE MAGNET

- **Protects Machinery**
- **Keeps Products Pure**
- **Prevents Fires**

Here's the MODERN METHOD of tramp iron removal that you pay for only once . . . low first cost (price as low as $21 for the 4" width!) . . . no second cost! No operating or maintenance expense . . . no wiring . . . trouble-free design . . . magnetic permanence guaranteed for installation life. *It's the new, powerful, non-electric Perma-Plate* that PAYS FOR ITSELF.

PERMA-PLATE PROTECTS $7000 DIE ROLLS

Here a Perma-Plate removes nails and other iron from roofing material *before* they can damage $7000 die rolls. Over-the-belt installation hinged for easy cleaning.

PUT A DINGS PERMA-PLATE ON YOUR PAY ROLL!

Whatever your tramp iron problem, you can save money by installing Dings low cost Perma-Plate . . . in chutes, ducts, pipes, over conveyors, etc. Highest grade Alnico plus advanced design insures maximum iron removal. Weatherproof . . . equally effective for wet or dry materials. Get all the details . . . Write today for Bulletin B-1205A. Ask about FREE TRIAL OFFER!

DINGS MAGNETIC SEPARATOR CO.
4730 W. McGeogh Ave., Milwaukee 14, Wis.

Est. 1899
Dings
"HIGH INTENSITY"

chemical products of the wood distillation industry (methanol, acetic acid, and acetone), many new fine chemicals isolated directly from the wood distillate (such as γ-butyrolactone, o-cresol, guaiacol, 4-ethylguaiacol, pyrogallol, 1,3-dimethyl ether, maltol, etc.) have appeared recently on the market in commercial quantities. These primary products open up possibilities of varied synthetic approaches.

The naval stores industry based upon the extraction of pinewood stumps has evolved into a complex terpene chemical industry, with many new pure terpene and terpene derivatives on the market. The raw materials for many of these same terpene processes are available also in the kraft pulping industry's byproduct sulphate turpentine and tall oil.

The sulphite pulp industry possesses in its sulphite waste liquor an enormous potential source of chemicals. The sugar content can be fermented to ethanol, butanol, acetone, lactic acid, or several other fermentation products, each of which may be employed in the synthesis of many other compounds. In fact, in Sweden, sulphite liquor ethanol is the raw material for the country's organic chemical industry. Western hemlock sulphite waste liquor may be extracted directly to obtain conidendrin which is valuable for the synthesis of antioxidants.

The lignin in sulphite waste liquor can be oxidized to give high yields of either vanillin or vanillic acid. These interesting compounds are valuable for the synthesis of numerous derivatives which have found utility as nontoxic food preservatives, efficient sunscreens and sunburn preventatives, plasticizers for transparent films and cellulosic materials, and therapeutic agents.

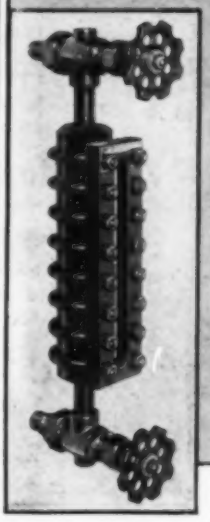
The hydrolysis of wood offers another source of sugars and fermentation products similar to those obtainable from the sugars of sulphite waste liquor.

Irwin A. Pearl, Institute of Paper Chemistry, before Division of Agricultural and Food Chemistry, American Chemical Society, Portland, Sept. 14, 1948.

Undergraduate Training For Market Analysts

Appraisal and development of markets for chemicals are part of the larger subject of the development of new and profitable fields of activity for the process industries. It seems evident, after reviewing the importance and complexity of the market analyst's problems, that his undergraduate training should be no different than that of anyone who intends to enter

When Liquids Boil and Surge the new JERGUSON LARGE CHAMBER GAGE Will Give You A Level Reading



WHEN liquids boil and surge, and use of a coolant is undesirable, the New Jerguson Large Chamber Gage will give you a level reading.

Ordinary gages do not give sufficiently accurate readings on such liquids where the level fluctuates rapidly in the glass. With this new Jerguson, however, the gage chamber is of such large diameter that the level is not badly upset by the boiling action of the fluid. This makes it possible to get close level readings, the kind of readings you want for safety and accurate control.

Don't be satisfied any longer with gages that require you to *guess* at level readings. If liquids boil, install Jerguson Large Chamber Gages and *be sure.*

The Jerguson Large Chamber Gage is the flat glass, reflex type. Write for full information on this and other Jerguson Gages.

JERGUSON
GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Representatives in Major Cities
Phone Listed Under JERGUSON

High Conversion

a big factor in low cost sulfuric acid production

The high production rate and low operating cost of modern Chemico Contact Sulfuric Acid Plants are largely due to the well-designed converters and the use of highly effective, non-poisonable Vanadium Catalyst. In a Chemico-built contact plant, you are assured of:

- ***High conversion . . . 96% to 98% SO_2 to SO_3***
- ***High overall operating efficiency of 94% to 96%***
- ***Long life of catalyst***
- ***Perfect control of temperatures for smooth operation***
- ***Maximum utilization of reaction heat through the use of an economizer after the secondary convertor***

Chemico Plants are profitable investments

CHEMICAL CONSTRUCTION CORPORATION

EMPIRE STATE BLDG., 350 FIFTH AVENUE, NEW YORK 1, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE
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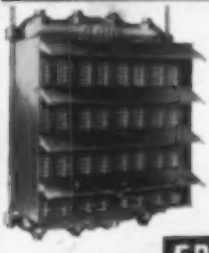
CC-169

THEY'RE DESIGNED AND MADE TO MEET CHEMICAL INDUSTRY REQUIREMENTS

Here's equipment that will stand up under conditions peculiar to chemical plants . . . equipment designed, engineered and constructed for dependable service without those expensive interruptions in your production . . . equipment with over 60 years of experience in manufacturing back of it. Let us send you complete information on any of the equipment illustrated . . . there's no obligation and you're certain to improve your production efficiency.

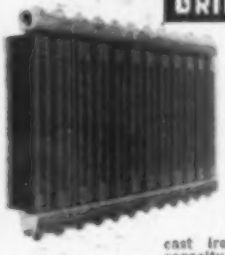
GRID UNIT HEATERS



More "free" area per foot of heating space in GRID products than any other. Hence, no clogging due to atmospheric conditions, dust, etc. And, easier to keep clean and operate at highest efficiency.

Every GRID unit is guaranteed for steam pressures up to 250 lbs. without reducing valves. Hence, no special piping arrangement necessary.

GRID BLAST COILS



For outside air, drying, process work, etc. GRID Blast Coils have the same high efficiency and lasting qualities as GRID Unit Heaters . . . no tortuous air passages . . . constructed to permit freedom of expansion with complete absence of ruptures, strains, and warping. Compact in design. GRID Blast Coils occupy less space than other types of cast iron blast coils of equal capacity.

GRID RADIATION

GRID heating sections are one piece construction high test cast iron—the metal most resistant to corrosive gases. Hence, no rotting away of heating elements, no leakage due to corroded joints, connections . . . no electrolysis because no dissimilar metals are used in GRID construction. Hence, no maintenance expense—but years of trouble-free heating service.

LEVEL VIBRATING DOUBLE DECK CHIP SCREEN

If you want faster, more profitable separation of materials in your processing, the MURCO Level Vibrating Double Deck Screen is designed as a high production unit for efficient operation . . . compact design that requires less space per ton capacity due to its low head room. Rugged construction throughout to withstand continuous service.

SCREW CONVEYORS AND FLIGHTS

Made to your specifications . . . in stainless steel and other metals . . . various diameters, lengths and pitch . . . continuous one-piece construction—welded, not cast . . . no laps or rivets . . . each section stronger.

Send us your specifications for quotation.

Write for complete details today

D. J. MURRAY MANUFACTURING CO.
WAUSAU, WISCONSIN

the chemical process industries, no matter what type of work he prefers. It is indicated that the modern chemical engineering curriculum is most suitable for the purpose.

D. B. Keyes, Heyden Chemical Corp., before Division of Industrial and Engineering Chemistry, American Chemical Society, Washington, Aug. 31, 1948.

Economics of Waste Wood Utilization

Wood is an attractive research material because of its chemical complexity and its potentiality as a raw material for chemical industry. Wood has the advantage of being a renewable resource which can be accumulated in large quantity.

Inventories show that in the principal timber areas, such as the Pacific Northwest, great amounts of wood fall into the category of waste wood both on the logging operations and produced as byproducts in the manufacturing operations. This fact coupled with the wide variety of substances that can be made from wood in the laboratory raises the potential value high, but the two facts join together only when economics permits.

There are two general approaches to any new development in wood utilization; first by the producer of primary products, such as lumber or plywood, and secondly by the entrepreneur who wishes to establish a new industry based on available raw material. In the first instance the producer of primary wood products desires a maximum utilization of his raw material and hence should produce as little wood waste as possible by efficient conversion to primary products. Only then should he inventory his byproduct raw material, ascertain its current values and uses as fuel, pulp chips, lath, etc.; and survey the amounts of different categories of wood waste available from other producers in the area. Based on the amounts, types, and costs of the raw-material available, a careful survey of markets, production costs, etc. is necessary before a development can be entered into.

The entrepreneur is interested in the largest available amount of a particular type of wood waste at the lowest possible price for the development of a given industry. He must survey the market, also make production estimates and take into account competing factors for the wood raw material, such as fuel use, etc.

Due to competition from other raw materials the principal uses of wood depend upon its own peculiar properties as exhibited in the solid or whole form (lumber, plywood, etc.) and in the fiber form (pulp, wall board, etc.).

FILTER CLOTH

FOR CORROSIVE LIQUIDS

Write us for new Acid and Alkali-proof FILTER FABRICS

"DURAKLAD"
"SARAN"

WOVEN GLASS CLOTHS
NYLON FABRICS

COTTON AND SPECIAL FABRICS FABRICATED INTO TUBES, BAGS, ETC., FOR ALL PURPOSES

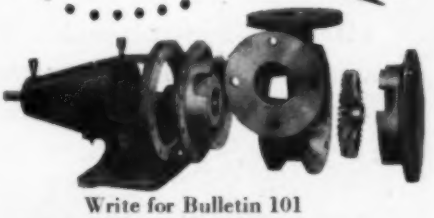
Write for prices. State size, width, quantity, type of filter used.

ALL KINDS OF DUST COLLECTOR BAGS

WM. W. STANLEY CO., Inc.
401 Broadway, New York 13, N. Y.

ROTH
STAINLESS PUMPS

Capacity 2 to 180 GPM
Head 0 to 400 Feet

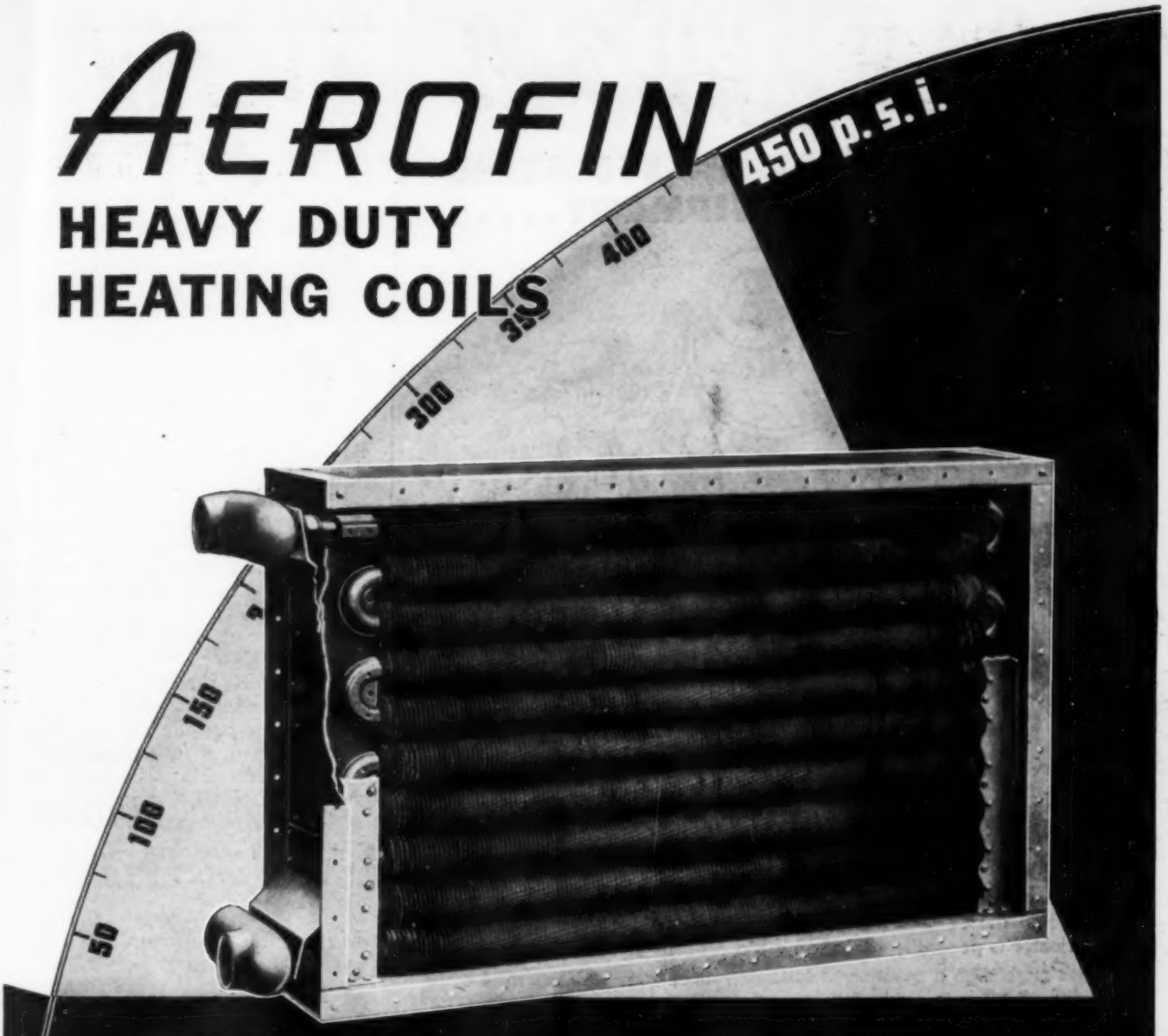


Write for Bulletin 101

ROY E. ROTH COMPANY
2480 4th Ave.
Rock Island, Illinois

AEROFIN

HEAVY DUTY HEATING COILS



for Operating Pressures 25 to 450 p. s. i.

Specially designed extra-rugged coil for unusually heavy duty. Continuous tube construction protects interior of coil against corrosion by positive and continuous purging of oxygen, carbon dioxide and other gases.

Each row is removable and replaceable. Rows up to 4' tube length are made of one continuous tube. Rows of 4' 6" and greater tube length contain only one brazed joint. All header joints are outside the coil casing – there are no internal joints to leak.

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E. C. Jahn, New York State College of Forestry, before Division of Agricultural and Food Chemistry, American Chemical Society, Portland, Sept. 13, 1948.

Growing Hard Board

MANUFACTURE of hard board on the Pacific Coast has obtained its greatest growth since the war. Several mills have started operations within the past year. The sources of fiber in most cases are wood waste from lumber mills, veneer plants, and low grade logs. Douglas fir is the principal species used although other species are used to some extent with good results. Board formation is mostly by the batch process. Both the wet process and the dry process are used to form the sheets. Some plants use synthetic resins to assist in binding together the fibers and to obtain the desired strength properties and water resistance. One plant claims several new features of manufacture which are advantageous from the standpoint of cost and source of wood fiber. Types of machines used for defiberizing the wood include: Allis Chalmers, hammermill, Asplund, Bauer, and steam explosion.

H. D. Erickson, West Virginia University, before Division of Agricultural and Food Chemistry, American Chemical Society, Portland, Sept. 13, 1948.

Market Development Of Furfural

FURFURAL is not new to certain basic industries. It was first made and sold commercially in 1922 and has therefore just reached its silver anniversary. It is new in the sense that it is still relatively little known to the average chemist and to the public, because it rarely reaches the ultimate consumer unchanged. Unlike other basic chemicals, it has not yet found its way into the average college laboratory, and the textbooks still contain only the briefest mention of furan chemistry.

Furfural is a chemical compound having the formula $C_4H_3O.CHO$. It boils at 323 deg. F., freezes at —35 deg. F., and is 16 percent heavier than water. It is quite stable under normal use as a solvent, and becomes readily reactive under proper conditions when used as a chemical raw material. It is manufactured from agricultural residues such as corn cobs by acid digestion, distillation, and refining.

Since raw materials of this type are renewed annually by nature, the availability of furfural is not depend-

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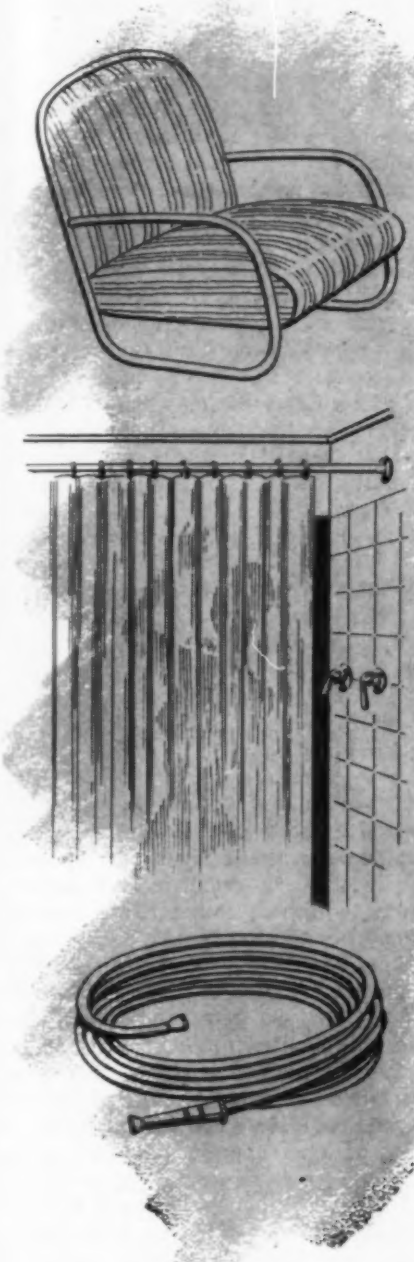

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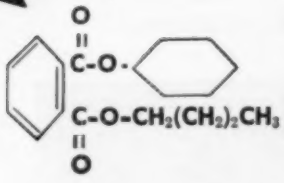

Color: Clear, practically water-white (Hazen, 50 max.)
Form: Liquid
Odor: Mild Ester
Distillation at 5 mm. hg, °C.: 189-222
Specific Gravity 25/25°C.: 1.076
Pounds per Gallon at 25°C.: 8.95
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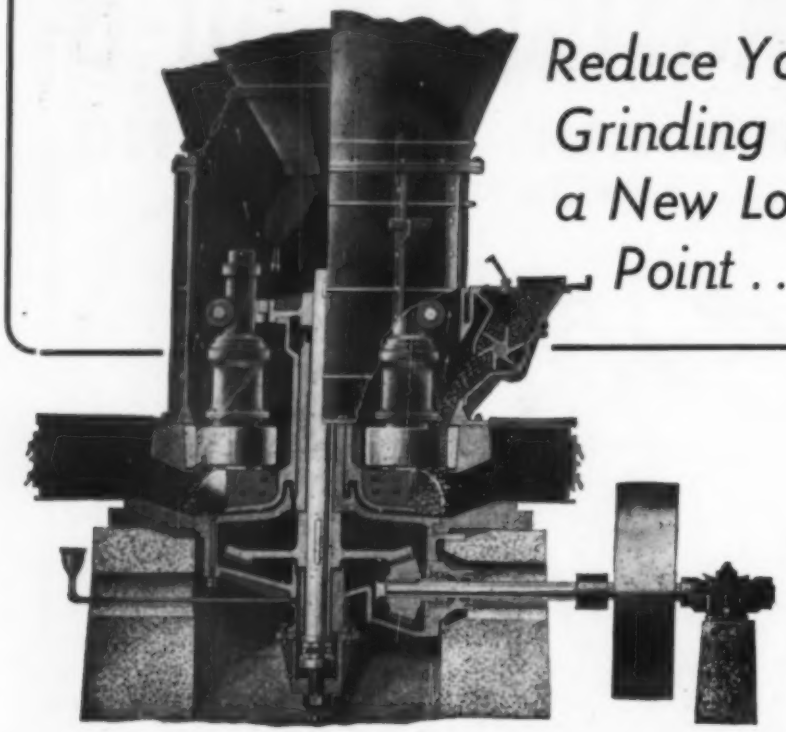

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ent upon mineral or oil reserves. At the present time, about 1 percent of such raw material is sufficient to supply the country's needs of furfural, so that availability is virtually unlimited, and will continue to be so long as man and beast depend upon the various grains.

In the decade preceding 1922 the manufacture of Bakelite was getting under way and there had been intimations that furfural, another aldehyde, could be used with phenol to make a resin. Since formaldehyde was then selling for about $1 per lb. as formalin, a 37 percent water solution, it was guessed that furfural might bring an equivalent price.

Solely because of the broad potentialities, a recommendation was made to the Quaker Oats management that research be continued, concentrating on the production of furfural from oat hulls.

The market development of furfural from its commercial beginnings in 1922 until 1930 consisted almost exclusively of the distribution of samples, advertising, talks before technical societies, publication of technical papers and laboratory research. Samples were sent in response to requests elicited by the very modest advertising and as a result of interest created by talks at technical meetings.

Laboratory research was directed at exploring uses suggested in a few limited field contacts, as well as within the research organization itself. Results of sufficient interest were obtained in many cases to justify publication of technical papers and reprints of these were circulated. Bulletins were published, summarizing known properties and suggested uses, but consisting largely of a comprehensive literature bibliography. Over the course of five or six years, these bulletins were distributed quite widely.

During the first few years, the samples which were distributed gratis were from 4 to 8 oz. in size; quantities of one pound and over were charged for at the prevailing prices of $1 per lb., gradually reduced to less than 20 c. in small lots by 1930. Samples were sent promptly in reply to requests and as orders and repeat orders began to come in they were also filled promptly. These came from resin manufacturers, lacquer manufacturers and concerns interested in fungicides, insecticides, weed killers, paint removers and miscellaneous solvents.

The small initial production facilities were contrived almost entirely from second-hand equipment and surplus use, pipes, valves and tanks lying around the plant. A new furfural plant was finished in 1936, and so 14 years after the first drum was shipped

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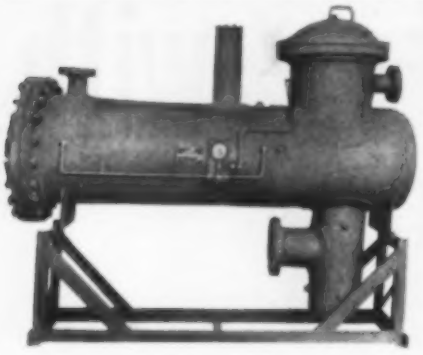

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in 1922, the first commercial plant to make furfural was in operation.

This plant had large excess capacity for the 1936 market, but by the start of World War II it was all in use. Government requirements for furfural in the solvent extraction process for butadiene in synthetic rubber suddenly came into being, calling for twice the maximum capacity of the existing plant. As a result, Quaker assisted in the design, construction, and operation of a new plant at Memphis, Tenn., which adequately supplied the synthetic rubber demand throughout the war. The output of the original plant at Cedar Rapids was allocated by War Production Board until the end of 1945.

Total furfural consumption declined somewhat after the war, though not to the prewar level, for its utility had been extended under the pressure of wartime development. The Memphis plant became surplus in 1946 and was purchased by Quaker.

The importance of timing seems to be rather seldom mentioned in analysis of market development. It seems to me to be of fundamental importance. How many attempts have been made to introduce a new chemical, using all of the best known technics, only to have the chemical go back on the shelf? How often are some of these same chemicals later taken off the shelf to provide an excellent solution to some problem newly arisen in chemical industry? A study of case histories in good and bad timing would be most instructive.

Lauren B. Hitchcock, Quaker Oats Co., before Chemical Market Research Association, Cambridge, Mass., April 8, 1948.

FOREIGN LITERATURE ABSTRACTS

Phosphorus Halogen Compounds

HALOGEN compounds of phosphorus, particularly PCl_3, PCl_5 and $POCl_3$, are widely used in organic synthesis as halogenating agents and also as agents which bring about reactions of condensation, splitting off of water, etc. These reactions utilize the ability of phosphorus halides to replace their halogen atoms with oxygen or hydroxyl groups. It was found that PCl_3 and PCl_5 combine comparatively readily with many of the organic compounds the molecules of which contain multiple bonds or a three-membered ring of the alpha-oxide. The chlorine atom of

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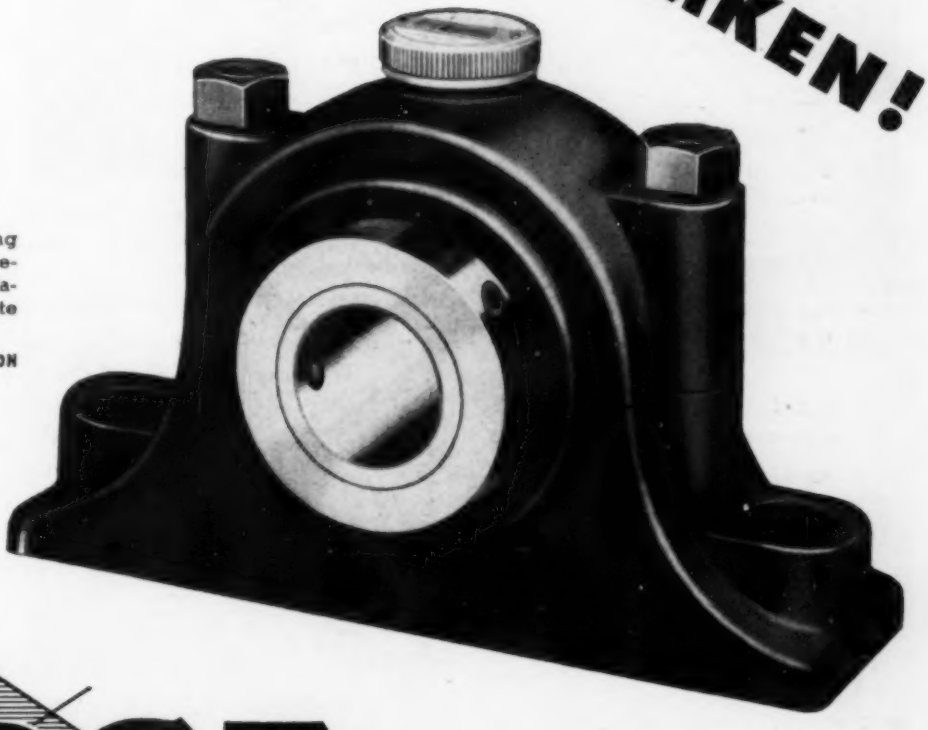

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the phosphorus halide combines with one of the atoms connected with the multiple bond (or with the carbon atom of the alpha-oxide), and the phosphorus radical PCl_2 or PCl_4 with the other one (or with the oxygen). These reactions can be considered as taking place through an ionic mechanism with formation of the condition $Cl\text{-}PCl_2^+$ and $Cl\text{-}PCl_4^+$. There is one thing in common in all reactions of phosphorus halides with organic compounds—PCl_3 and PCl_5 combine only with strongly polar multiple bonds or with a three-membered ring of the alpha-oxide. Addition reactions of the halogen compounds of phosphorus with unsaturated compounds, saturated and unsaturated aldehydes and ketones and alpha-oxides is a method for the preparation of various phosphorus organic compounds: saturated and unsaturated phosphinic acids, their halogen substituted derivatives, oxy- and keto-phosphinic acids, their acid chlorides, esters and so forth. Their advantage over known methods for the preparation of phosphorus organic compounds lies in the fact that they can be used for the synthesis of compounds with mixed functions which contain other functional groups in addition to the phosphorus-containing groups.

Digest from "Addition of Halogen Compounds of Phosphorus to Organic Compounds" by M. I. Kabachnik, *Uspekhi Khimii* XV, No. 4, 403-421, 1947. (Published in Russia.)

New Divinyl Trimer

CATALYTIC thermopolymerization of divinyl over floridin at a temperature range of 300-400 deg. results in the formation of a mixture of polymers, among them a trimer which was found to be 1,4,5,8,9,10-hexahydro-1,4-dimethylnaphthalene with the possible admixture of 1,2,5,8,9,10-hexahydro-1,2-dimethylnaphthalene. Its structure was determined by subjecting it to dehydrogenation over a nickel catalyst deposited on aluminum oxide. The resulting products, 1,4- and 1,2-dimethyltetrahydronaphthalenes, yielded only phthalic acid when oxidized with permanganate.

Digest from "Polymerization-Depolymerization. III New Trimer of Divinyl" by J. M. Slobodin, F. V. Rachinsky and I. N. Shokhor, *Zhurnal Obshchei Khimii* XVII, No. 9, 1659-1661, 1947. (Published in Russia.)

High Temperature Chemistry

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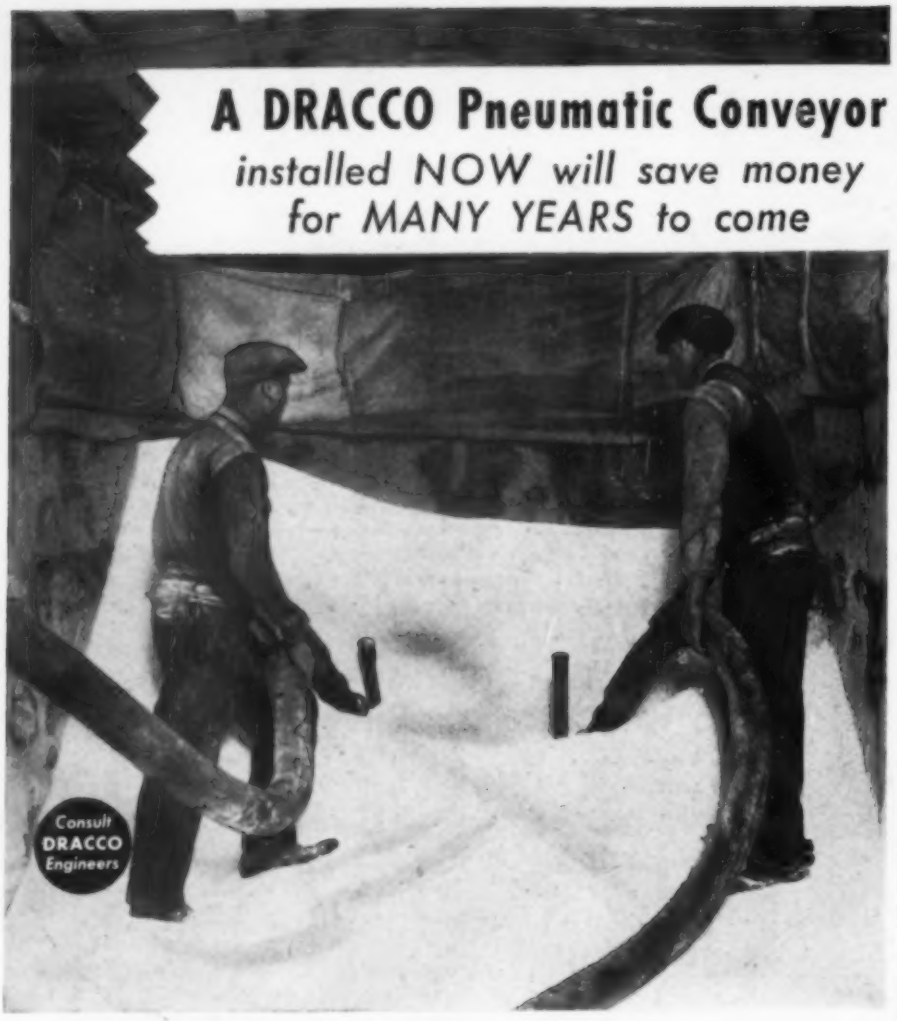

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Digest from "High Temperatures, Future of Inorganic Chemistry" by Felix Trombe, *Revue Generale des Sciences*, LV, No. 4-5, 89-97, 1948. (Published in France.)

Fibrous Materials for Cellulose Acetate

SUITABILITY of plant raw materials for conversion to cellulose acetate depends chiefly on two factors in addition to the degree of polymerization: chemical purity and reactivity. The first determines the degree of turbidity of the solution, the second the general applicability of the material. A simple method has been developed for measuring quantitatively the reactivity of fibrous materials for the acetylation reaction. It depends on the comparison of the results of a standardized method, such as that of preliminary activating treatment with glacial acetic acid at 90 deg., to those obtained by simple preliminary soaking with glacial acetic acid at room temperature. The changes taking place in the course of acetylation, characterized by the same criteria as in the original method, are an excellent and discriminating measure for the reactivity of celluloses in acetylation.

Digest from "Suitability of Fibrous Materials for the Preparation of Cellulose Acetate. II Determination of Reactivity" by G. Jayme and U. Schenck, *Angewandte Chemie A* 60, No. 2, 46-47, 1948. (Published in Germany.)

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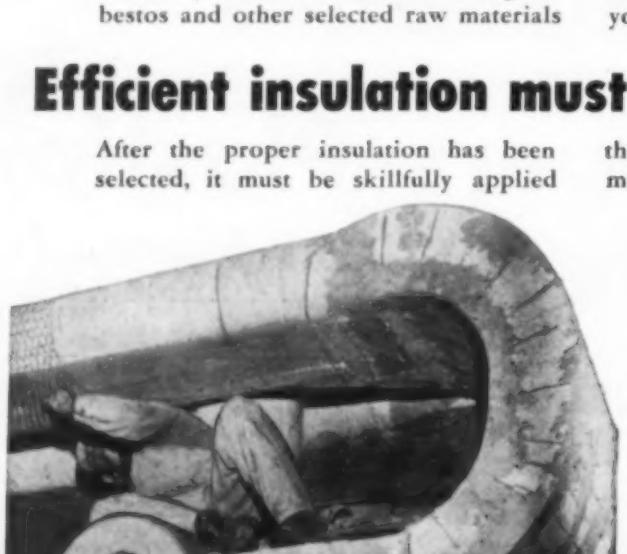

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Chemical Engineering Vertebrae

INORGANIC PROCESS INDUSTRIES. *By Kenneth A. Kobe. The Macmillan Co., New York. 371 pages. $6.*

Reviewed by John R. Callaham

K. A. Kobe

ONE thing, I feel more keenly with time, has needed more emphasis in our chemical engineering cosmos, both in the universities and outside: a greater appreciation of the opportunities for applied modern engineering in inorganic chemical technology. The signs of recent years indicate that this need is being recognized.

There's still more than one inorganic chemical plant now being operated in this country that would not appear out of place if transplanted back into the 19th century. That the chemical processes themselves may be almost a century old is natural and understandable; that the engineering techniques and materials are hoary with age is a sad commentary on the lop-sided application of chemical engineering. In our latter-day enthusiasm for the organic millenium, we have sometimes neglected to keep in trim all the vertebrae of that real backbone of the chemical and process industries —applied inorganic engineering.

True, most of the heavy acid, alkali and salts industries are built on superb engineering skill. But go back to the second-line inorganics of commerce and there you will find that technological progress over the decades has often slowed down to a shuffle. Markets and profit margins are too small to warrant a greater investment in development and engineering programs, it is sometimes argued. But present investment costs in technical personnel are almost as low—even on an individual basis—as for skilled labor; the long-range dividends cannot be compared. Within the past year I have learned of at least two small firms that have gone into the manufacture of second-line inorganics knowing that the odds were against them. Both applied modern engineering methods to the limit; both are now carrying their success to the very backyards of their old-line competitors.

Kobe's textbook, I feel, is a step in the right direction at the right place. His philosophy: "The student who learns about the chemical process industries without appreciating their rate of growth, the rapidly changing technology, and the economic forces affecting the industry has not been properly trained." It is obvious that he intends to teach his students three fundamentals: (1) inorganic chemical technology is (or should be) dynamic and never static; (2) economic as well as technological factors control the rise and decline of every industry, every process, every individual enterprise; (3) "the student who does not maintain contact with the important advances . . . described in the technical journals is playing Rip van Winkle."

One point, neither the fault of the author nor the publisher, on which I would like to spill a bit of spleen is the $6 cost of this 370-page textbook. In a democracy of education, there's something ironical and irritating when students too must subsidize the fancy wage rates prevalent everywhere, including print shops.

Food Research

SURVEY OF FOOD AND NUTRITION RESEARCH IN THE UNITED STATES, *1947. Compiled and published by Food and Nutrition Board, National Research Council, 2101 Constitution Ave., Washington, D. C. 306 pages. Price $1.*

THIS is a compilation of research undertakings on food and nutrition which are in progress in academic, governmental, and industrial laboratories. The survey was conducted by Food and Nutrition Board with the support of the Quartermaster Corps in order that the government might be acquainted for defense reasons with all of the scientific activities of this character in progress everywhere.

The compilation is announced in tabular form identifying by title and active laboratory each project which has been reported by some 600 institutions. The listing is classified according to major subjects such as physiology, chemistry, technology, bacteriology, etc.

Three excellent indexes are included in the volume. The first permits identification by the name of the individual having charge of each project. The second gives an alphabetical list of the organizations which collaborated. The third identifies the various undertakings under a wide variety of subjects, commodities, and other characteristics of the investigations. Thus one seeking information about any of the thousands of entries can rather readily find all pertinent items whatever the means of approach used.

One Facet

HEAT CONDUCTION WITH ENGINEERING AND GEOLOGICAL APPLICATIONS. *By Leonard R. Ingersoll, Otto J. Zobel and A. C. Ingersoll. McGraw-Hill Book Co., New York. 278 pages. $4.*

Reviewed by William J. Shore

THE COMBINED efforts of three scientists have resulted in a technical study of the phenomena of heat conduction, which is, to say the least, a highly provocative and stimulating study of this most interesting natural process. The authors preface their work con-

RECENT BOOKS RECEIVED

Atomic Energy. By K. K. Darrow. Wiley. $2.

Alkylation of Alkanes, Vol. I. By G. Egloff & G. Hulla. Reinhold. $20.

Chemistry of Insecticides, Fungicides and Herbicides. 2nd ed. By D. E. H. Frear. Van Nostrand. $6.

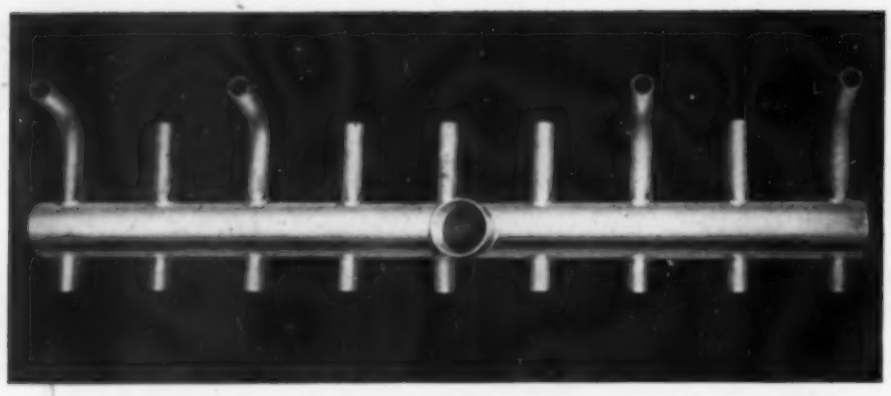
Introduction to Chemical Thermodynamics. 2nd ed. By L. E. Steiner. McGraw-Hill. $6.

Organic Chlorine Compounds. By E. H. Huntress. Wiley. $27.50.

Organic Reagents Used in Gravimetric and Volumetric Analysis. By J. F. Flagg. Interscience. $6.

Public Health Engineering, Vol. I. By E. B. Phelps. Wiley. $7.50.

Scientific Russian Reader. By N. D. Gershevsky. Pitman. $3.50.



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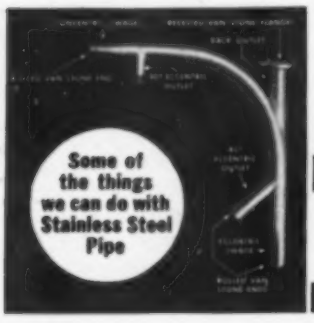

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cisely, . . . "The aim . . . is to develop the subject to the student who has neither sufficient time nor mathematical preparation . . . and to point out the many applications of which results are susceptible . . .". The authors have achieved their purpose with varying degrees of success.

Despite their feeling that the mathematics are simple and readily grasped, it is found that to understand the various mathematical developments presented requires a good working knowledge of the calculus and higher mathematics. The graduate student and the physicist who have actively devoted their efforts along these lines will find the mathematical studies and presentation of intense interest. This book undoubtedly meets a definite need for further and graduate studies of this branch of physics.

The second purpose of this book is to set forth various applications of common knowledge and daily practice where these mathematical conclusions may be used in solving more precisely problems relating to heat conduction which in the past have been solved better or worse through empirical methods and process. It is amazing to note the many instances in our daily contacts where heat conduction plays important parts. These comprise furnaces of all sorts and refrigerators, natural ice production on lakes and rivers, with geysers and underearth heat sources. Fireproofing and insulating buildings, problems relating to the freezing or the cooling of large masses of concrete, canning foods, drying wood, welding metals, annealing castings—all of these comprise a list of practical problems that is high, wide and handsome. It would have been interesting had they included studies on the quick freezing of food products, and the heat conduction of the new methods for heating houses by laying pipes in the concrete floor slabs, both of which systems are becoming very much a daily part of our modern and fast moving scene.

The authors have compiled a most exhaustive list of studies, papers, treatises, record of experiments and other printed data and research on the subject of conduction. All in all there are a list of 163 authors and subjects on this study relating to the conduction of heat. This list should be of inestimable advantage to both students and practicing engineers. The book has a first class index and is thoroughly documented throughout its entire contents. The Appendix includes a most complete list of thermal conductivity and diffusivity of various materials both in the CGS and the FPH systems.

It may be that considerations of space and weight made it impossible

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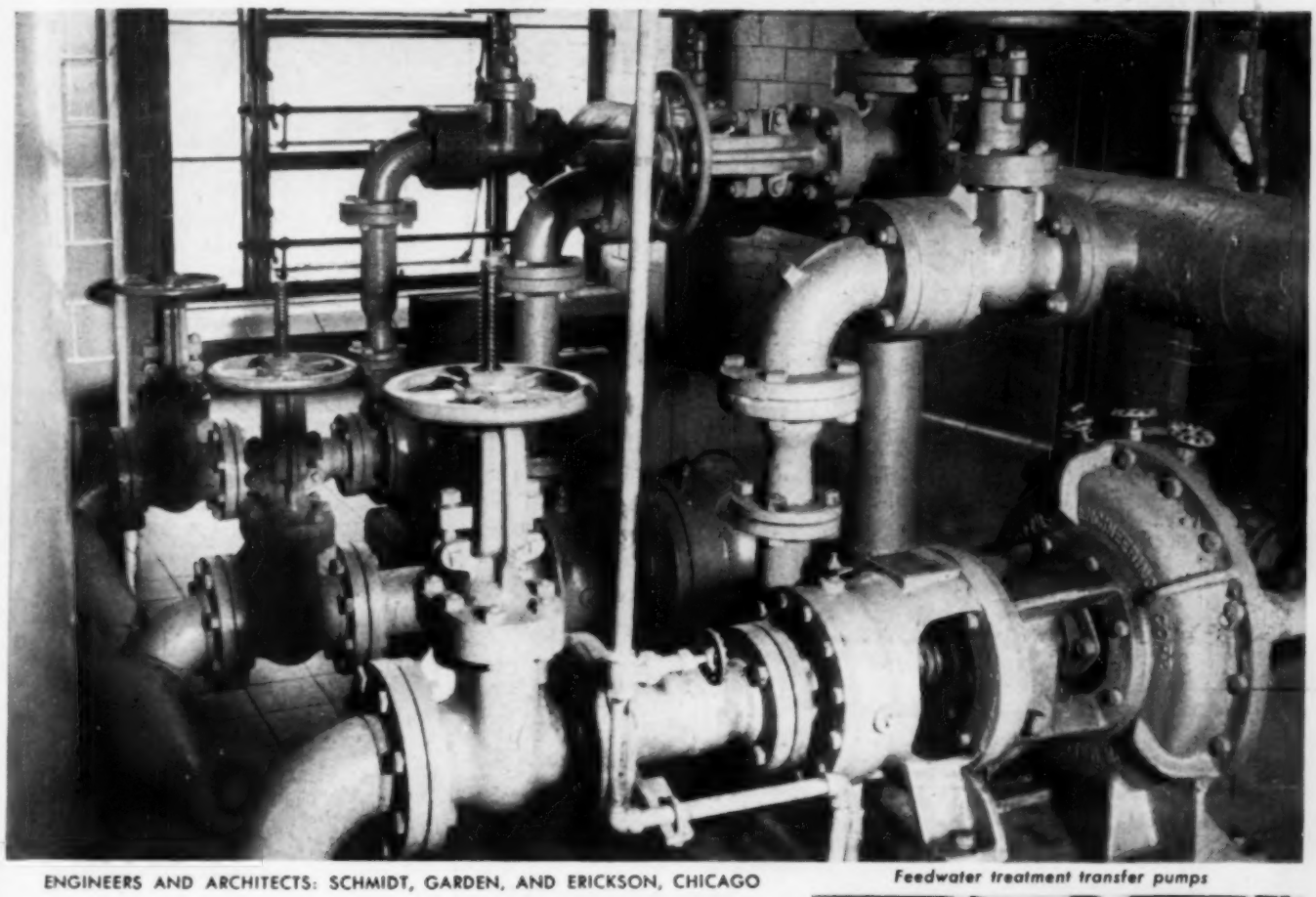

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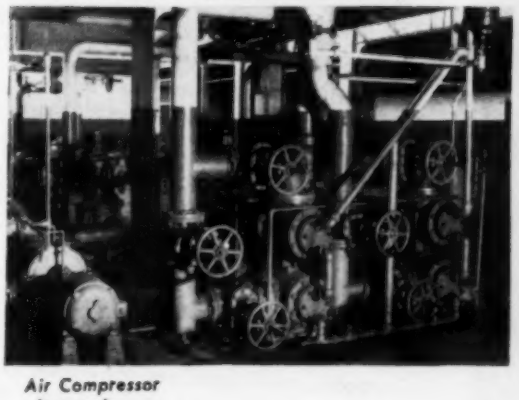
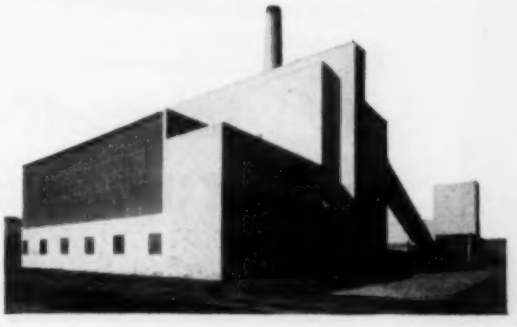


Air Compressor after-cooler



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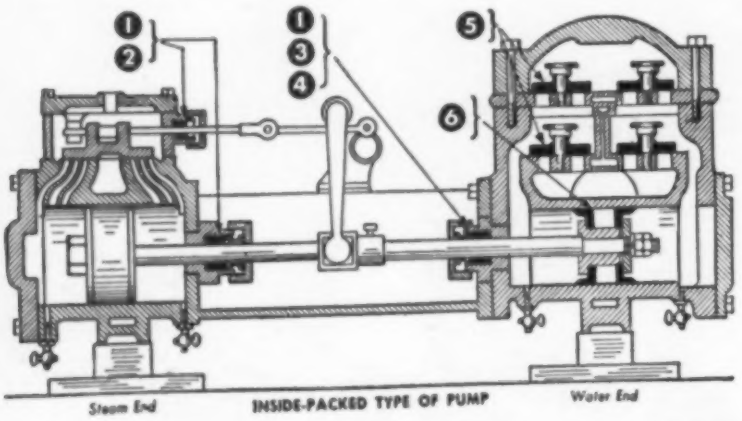

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to make more use of drawings and illustrations. More of these would prove both interesting and helpful to the reader. They would provide a more ready grasp and understanding of the various problems that are presented and solved. All the various problems are complete with answers which is useful and truly important.

Because this book deals only with heat conduction, the authors of this book are handicapped most seriously at times. No heat phenomena exist without all three types of transfer taking place: radiation, conduction and convection. Thus it becomes necessary for the authors to make assumptions in many instances that only conduction takes place, whereas in practice this is seldom true. Once in a great while the authors make use of simple methods, and in an aside apologize to the reader for such as being crude and approximate. In many of the instances they cite and calculate they overlook other phenomena and so tend to become unreliable. Thus in one instance where they make calculations relating to the insulation of an airplane cabin, they do not take into consideration the velocity of outside winds and thus render their calculations good only for a condition existing in a hangar and not in service in the air and in flight.

This book is an excellent piece of work and has been carefully prepared and edited. The various elements of the subject have been presented with enthusiasm and in a lively manner. Those dealing with the phenomena relating to the age of this earth are of special interest even to the least scientific of engineers. The authors of this most useful work are to be commended for their painstaking study in the presentation of this subject. The book is decidedly a worthwhile contribution to the search of knowledge and more complete data on a subject that for many years could be treated only in a haphazard hit-or-miss fashion.

It is books such as this that are the foundation upon which most of our supremacy in the industrial arts has been built. It is hoped that there will be many more like it in times to come.

Enzymology

CRYSTALLINE ENZYMES. *By John H. Northrop, Moses Kunitz, and Roger M. Herriott. Columbia University Press, New York. 352 pages. $7.50.*

THIS is a new edition of a book published in 1939 under the same title, and treats of the chemistry and isolation of proteolytic enzymes and bacteriophage. New material covered in this edition includes a discussion of the methods of preparation and prop-

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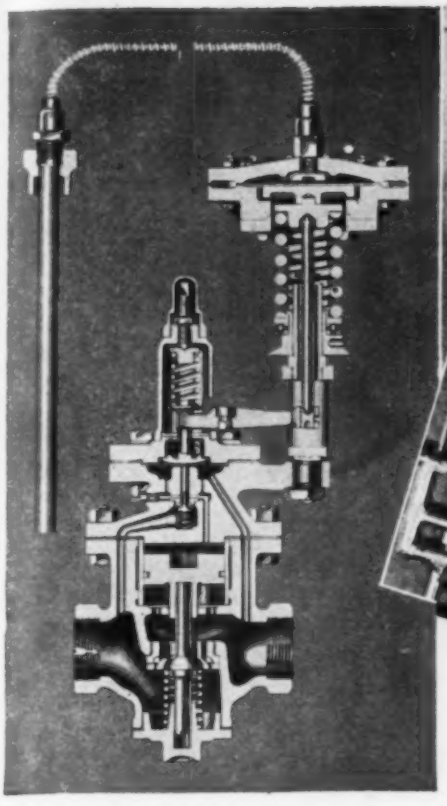

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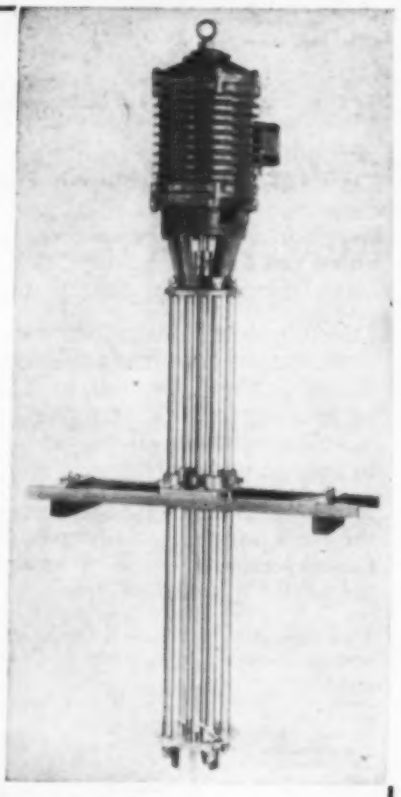

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erties of the enzymes ribonuclease and hexokinase. An appendix of over sixty pages contains methods of preparation and crystallization of enzymes. The subject matter of the text is based on work carried out in the Laboratory of General Physiology of the Rockefeller Institute for Medical Research at Princeton, N. J.

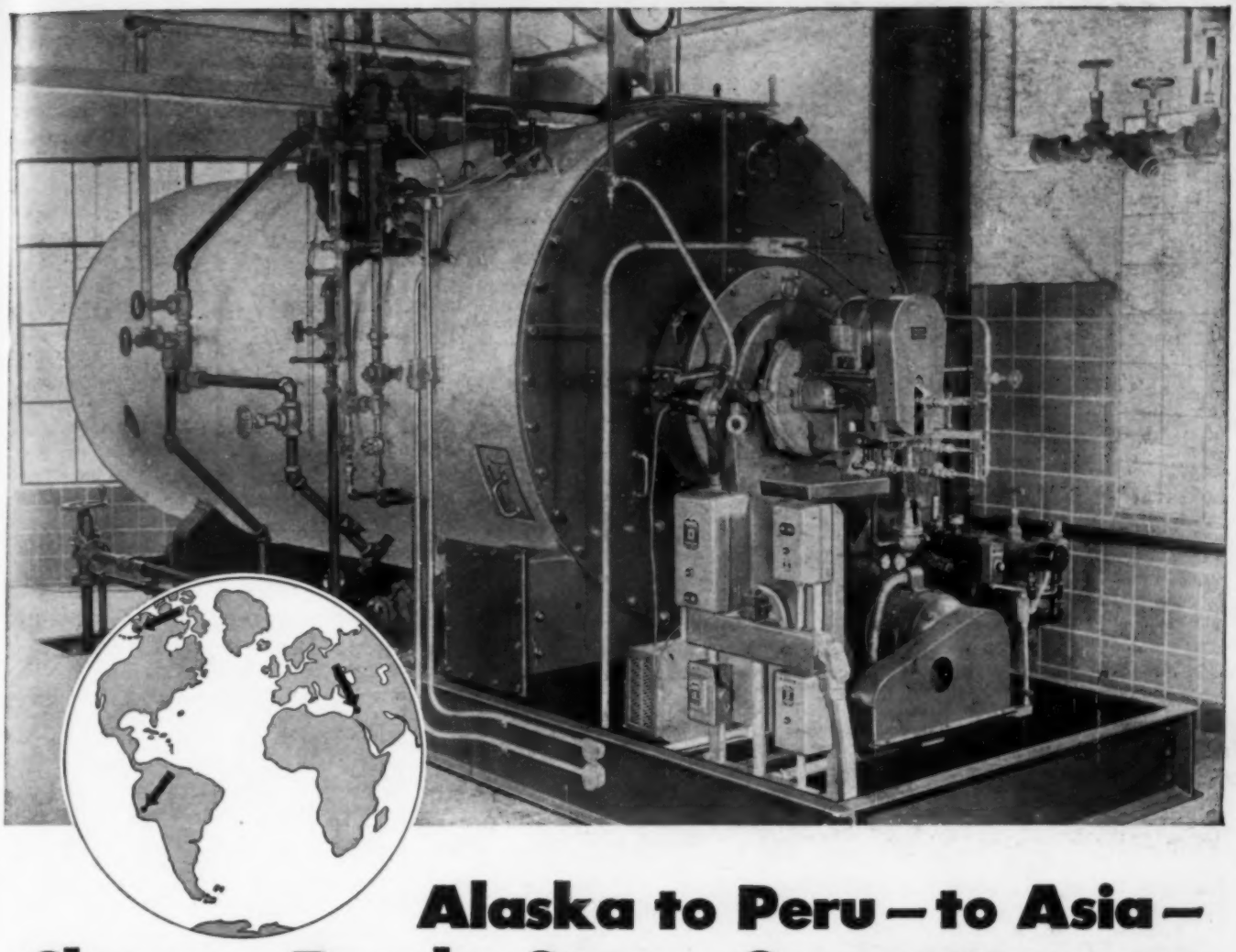
You Can Learn Russian

CHEMICAL RUSSIAN, SELF-TAUGHT. *By James W. Perry. Journal of Chemical Education, Easton, Pa. 221 pages. $3.*

Reviewed by Ludmilla I. Callaham

DR. PERRY'S book will be particularly welcome to those chemists and chemical engineers who are not connected with some large firm or organization employing a qualified translator. A surprising number of the free-lance technical translators available do not have an elementary knowledge of chemistry, and their English is of even more doubtful quality than their Russian. I have seen professional translations where carbon monoxide was translated as carbon monoxide and dioxide alternately. A non-technical man is not always aware of the importance of accuracy and his translations may be more confusing than helpful to an American researcher.

Since really qualified translators are rather expensive, anyone who needs to refer to Russian periodicals with reasonable frequency would find it well worth his while to study Russian for himself. The language, and especially its technical form, is not particularly difficult to learn. It is reasonable, direct and phonetic. Dr. Perry is right in saying that aptitude for learning languages is really the ability to acquire new thought habits; chemists therefore have a right to consider themselves qualified. In my opinion, most of the people who are supposed to have linguistic ability merely have a good ear and memory. Memory can be developed by use, and the ability to pronounce words perfectly is of little importance to a chemist. Since every chemist has to be reasonably intelligent, he needs only persistence and "Chemical Russian, Self-Taught" to learn this scientifically important language. Dr. Perry says that it would require approximately a year, with an hour's study each day, to learn to read Russian fairly well. All progressive scientists have considerable experience in studying by themselves, however, and should absorb a great deal more knowledge in a given period of time than the average student. I therefore feel that anyone devoting half an hour each evening to Russian instead of the usually recommended "cultural"



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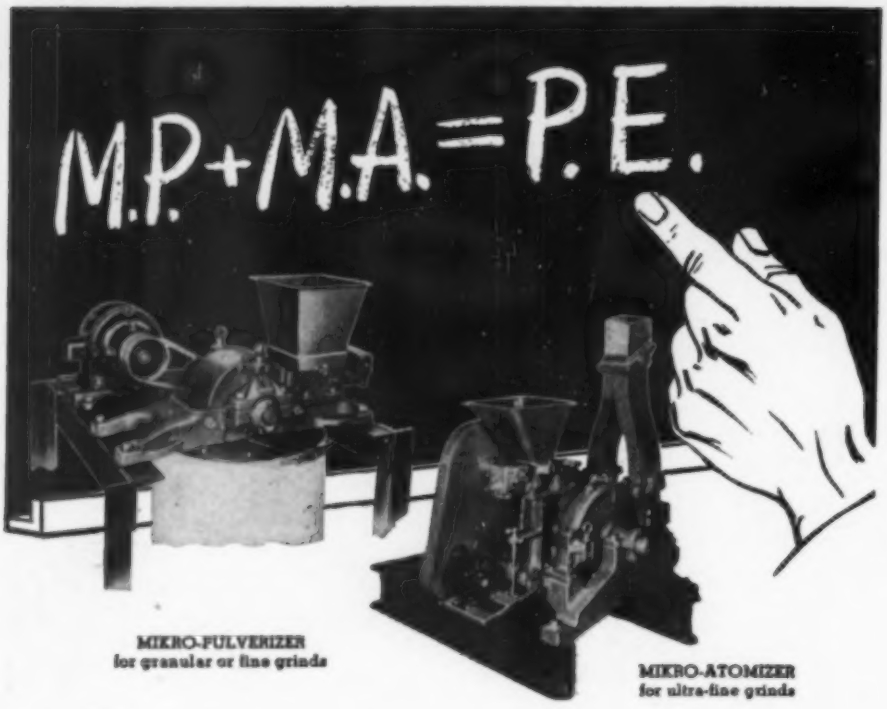

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literature, could master technical Russian adequately in six months.

Any chemist at all interested in studying Russian should be much encouraged on reading Dr. Perry's chapter entitled "Suggestions for Study Methods." Here the approach to study of Russian is analyzed logically and clearly. And he will certainly want to take advantage of all the useful material packed so solidly into the thoughtfully organized chapters on Vocabulary Problems, Inorganic Chemical Nomenclature, Organic Chemical Nomenclature, and Russian Grammar, as well as the Glossary of Technical Terms which contains almost 2,000 words. In fact, this book would be a good investment even to those chemists who want to learn only enough Russian to read the titles of technical articles.

Petroleum

PETROLEUM PRODUCTION. Vol. IV, *Condensate Production and Cycling. By Park J. Jones. Reinhold Publishing Corp., New York. 238 pages. $5.*

Reviewed by James F. Cosgrave

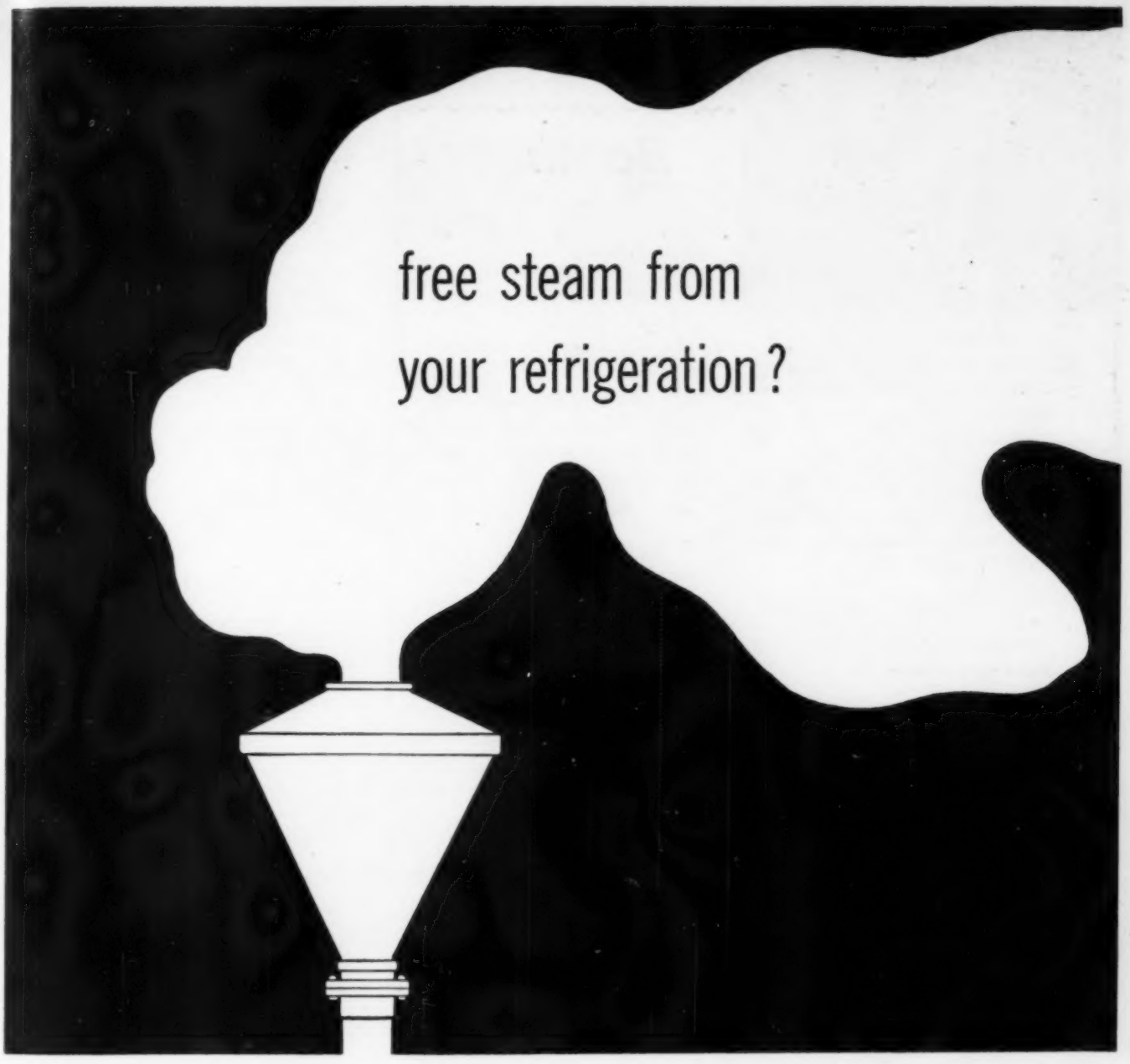
ON PAGE one the author starts his discussion of 146 sets of curves and drawings, 55 tables and over 200 equations. Only readers well acquainted with the subject will be able to follow the concentrated dose of theory that follows.

First part of the book gives theoretical foundations on condensation in reservoirs, injection into rich gas and into water, production by expansion, displacement and expansion, and economics of condensate production. The second part discusses applications in radial, elongated and linear reservoirs and maximum efficient rate of production. Included in the ten chapters are procedures for estimating the reservoir liquid loss in terms of the condensation observed under equilibrium conditions, for locating producing and injection wells to the best advantage, and for selecting size of tubing and estimating producing and injection wellhead pressures. The advantages and disadvantages of injecting gas into water are reviewed. Economic balances between compressors and number of injection wells are indicated.

Market Study

HOW TO MAKE A LOCAL AREA TRADE SURVEY. *Chamber of Commerce of the United States, Washington 6, D. C. 113 pages. Single copies free.*

THE MAJOR pamphlet of this title is a report of the Domestic Distribution Department of the Chamber of Com-



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RECENT BOOKS AND PAMPHLETS

Metal Spraying and Sprayed Metal. Third edition. By W. E. Ballard. Distributed by American Metallizing Contractors Association, 773 Brownell Ave., St. Louis 22, Mo. $10. Of British origin, the book leans somewhat toward British practice.

Nuclear Charts. Published by Westinghouse Electric Corp., 306 Fourth Ave., Pittsburgh 30, Pa. $1. Six lithographed wall charts in two colors illustrating the important areas of nuclear physics. The charts measure 25 by 36 in., made of heavy stock and are accompanied by a 32-page book of supplementary information.

Salt as a Corrosion Problem. Published by The International Nickel Co., 67 Wall St., New York 5, N. Y. 22 pages. Covers important industrial uses of salt with emphasis on resistant equipment for refining salt and for handling brine after it is refined and put to work by chemical industry.

Cottonseed Hulls as an Insulating Material. By W. E. Long. Research Report No. 2, published by Texas Engineering Experiment Station, College Station, Tex. 12 pages.

Process Engineering. By William H. Schutt. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. 309 pages. $4. Guidance in the entire procedure of cost estimating including demonstrations involving every kind of work on power-presses, lathes, drills, etc.

Proceedings of Heating and Drying Conference. Published by the Institute of Textile Technology, Charlottesville, Va. 88 pages.

Bibliography of the Literature on Sodium and Iodine In Relation to Plant and Animal Nutrition. Vol. I. Published by the Chilean Nitrate Educational Bureau, Inc., 120 Broadway, New York 5, N. Y. 123 pages.

The Kelley Statistical Tables. By Truman Lee Kelley. Published by Harvard University Press, Cambridge, Mass. 223 pages. $5. Revised 1948. Tabled entries to eight figures.

Bibliography of the Literature on the Minor Elements and Their Relation to Plant and Animal Nutrition. Fourth edition, Vol. I. Published by the Chilean Nitrate Educational Bureau, Inc., 120 Broadway, New York 5, N. Y. 1037 pages.

Distillation Literature 1941-1945. Prepared and published by Elizabeth and Arthur Rose, 525 South Gill St., State College, Pa. 191 pages. $5. An index and compendium of abstracts on distilla-

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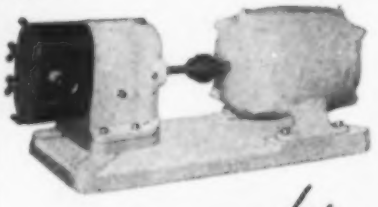

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tion in mimeographed form. Abstracts are arranged alphabetically by authors and reference is given to Chemical Abstracts as well as to the original journal article.

Symposium on Rubber Testing. Special Technical Publication No. 74, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 109 pages. $2. Eight papers presented at the 1947 annual meeting.

Standard Rules for Field Welding of Steel Storage Tanks. Published by the American Welding Society, 33 West 39th St., New York. 19 pages. 50 cents.

Opportunity Handbooks. Issued by Chamber of Commerce of the United States, Washington 6, D. C. Describing "A Program for American Opportunity" in a series of management-aid handbooks. Six items of the series now available, without charge for single copies. Where numerous copies are desired they are offered for sale at 5c. each.

Industrial Air Sampling and Analysis. By Leslie Silverman. Chemistry and Toxicology Series; Bulletin No. 1 published by the Industrial Hygiene Foundation, 4400 Fifth Ave., Pittsburgh, Pa. 72 pages. Outline of latest developments in sampling workroom air to detect health hazards and impurities.

U. S. Regional Industry. By Graham W. Parker, 230 Park Ave., New York 17, N. Y. 28 pages. $2. Contains four sections covering the definition of a decentralized industry, kinds of plants, technical and production developments and their impact on specific areas.

Calcium Carbide. Chemical Safety Data Sheet SD-23, published by the Manufacturing Chemists' Association, 608 Woodward Building, Washington 5, D. C. 12 pages. 20 cents. Safe handling and use.

Survey of University Patent Policies. By Archie M. Palmer. Published by National Research Council, 2101 Constitution Ave., Washington 25, D. C. 168 pages. Policies, procedures and practices of educational institutions in the handling of patentable research results.

Underwater Explosions. By Robert H. Cole. Published by Princeton University Press, Princeton, N. J. 437 pages. $7.50. Fundamental physical properties and the most generally useful theoretical methods for discussion of shock-wave development and propagation and of later motion of the explosion products are developed from first principles.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

The Small Businessman and His Financial Statements. By Gerald M. Francis. U. S. Department of Commerce, Economic (Small Business) Series No. 70. Price 15 cents. A draft of recommendations intended primarily for the "small businessman."

Aromatic Cyclodehydrogenation. By M. Orchin, et al. Bureau of Mines, Technical Paper No. 708. Price 20 cents. Comprehensive review of the experiments that have been performed in the synthetic liquid fuels laboratory of the Bureau in obtaining highly condensed

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Blue Cross and Medical Service Plans. Catalog No. FS 2.2:B 62. Price $1.25. Includes hospital plans, medical plans, and some problems of hospital and medical plans.

United States Petroleum Refining, War and Postwar. U. S. Department of Commerce, Industrial Series No. 73. Price 30 cents. Illustrated resume of scope and location of the industry and the types of equipment and methods used.

Pyrometric Practice. By Paul D. Foote, et al. National Bureau of Standards, Technologic Paper No. 170. Price 75 cents. A complete treatise on the practical phases and applications of pyrometry, first issued in 1921, reprinted in response to numerous requests.

Wool During World War II. By John W. Klein. Bureau of Agricultural Economics, War Records Monograph—7. Processed. A comprehensive statistical summary of the industry and its products and byproducts.

Index of N.A.C.A. Technical Publication, 1915-1947. Available on request to National Advisory Committee for Aeronautics, 1724 F Street N. W., Washington 25, D. C. A cumulative index from the founding of NACA through the late war period, invaluable as a library guide.

Survey of Paper and Paper Products Manufacturers. Office of Temporary Controls, OPA Economic Data Series No. 25. Price 15 cents. Over-all and average sales, cost, and profit and loss data, various periods, 1936-46.

Outline of Ground-Water Hydrology (with definitions). By Oscar E. Meinzer, U. S. Geological Survey Water-Supply Paper 494. Price 20 cents. A reprint of material long out of print. Gives broad descriptive details valuable for engineers working on water-supply problems.

Ground Water in the United States. By Oscar E. Meinzer. U. S. Geological Survey Water-Supply Paper 836-D. Price 25 cents. A summary of ground-water conditions and resources, utilization of water from wells and springs, methods of scientific investigation, and literature relating to the subject. A reprint.

Publications of the Geological Survey. May 1948. Available on request to Director, U. S. Geological Survey, Washington 25, D. C. Complete list of publications to date and description of important maps and charts, with prices of documents still available for purchase. Invaluable for librarians.

The Light-Metals Industries in China. By Richard E. Kleinhans. Bureau of Mines, Mineral Trade Notes, Special Supplement No. 23 (to Vol. 26, No. 2). Mimeographed.

Production of Sponge Iron: Gaseous Reduction of Iron Oxide Glomerules in a Shaft Furnace. By Edward P. Barrett and Carl E. Wood. Bureau of Mines, Report of Investigations R. I. 4305. Mimeographed.

Survey of Commercial Aviation Gasoline Characteristics, July 1947 Production. By W. C. Holliman, et al. Bureau of Mines, Report of Investigation R. I. 4353. Mimeographed.

A Selected Bibliography on Briquetting of Coal and Other Carbons. By Paul L. Fisher. Bureau of Mines, Information Circular I. C. 7469. Mimeographed.

Ignition Qualities of Hydrocarbons in the Diesel-Fuel Boiling Range. By A. D. Puckett and B. H. Caudle. Bureau of Mines, Information Circular I. C. 7474. Mimeographed.

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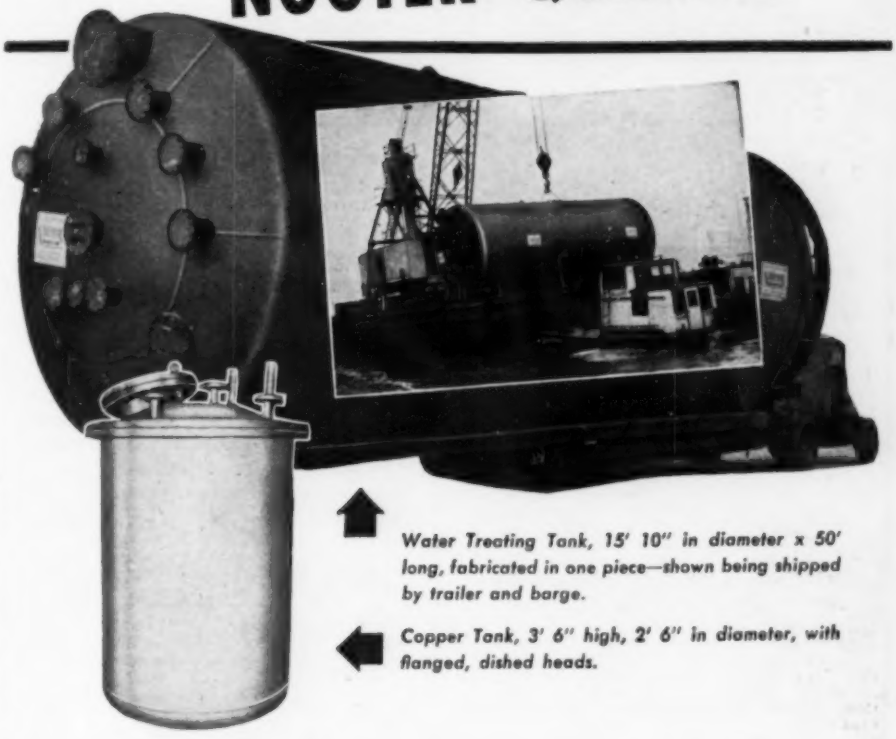

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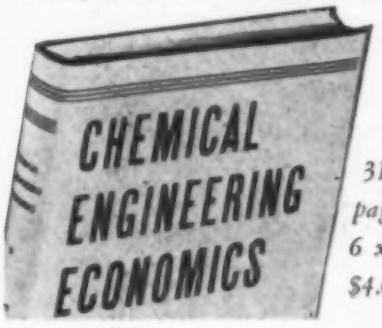

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(Continued from page 158)

of Electric Motors." Gives detailed specifications covering squirrel-cage induction motors, wound rotor and direct current motors.

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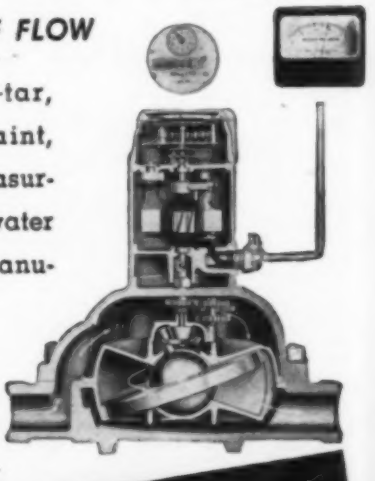

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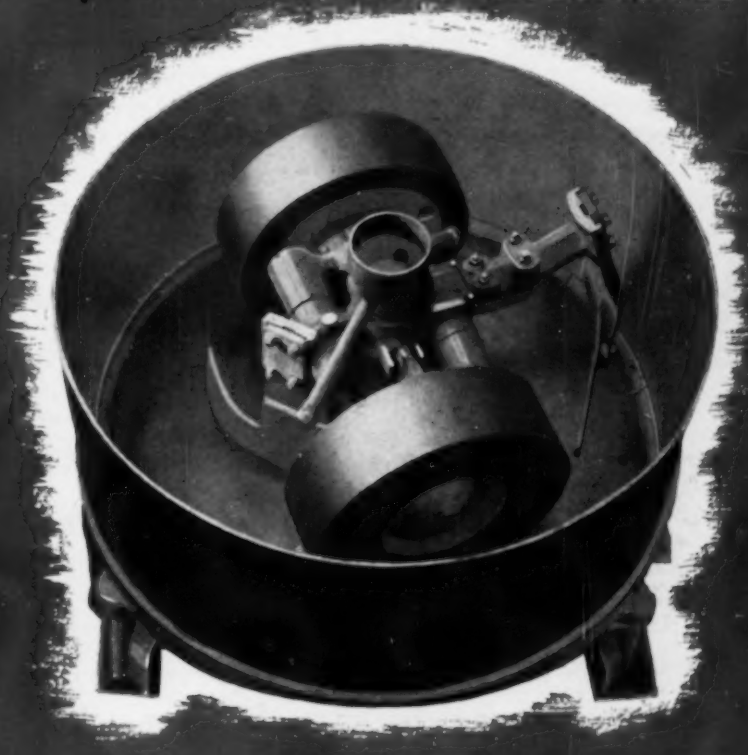

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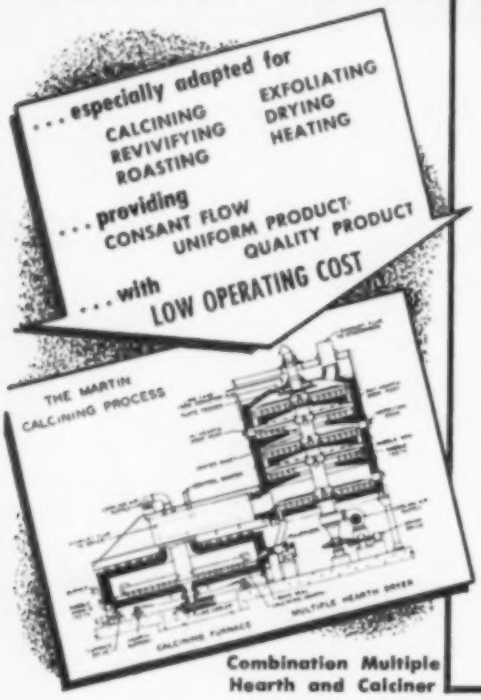

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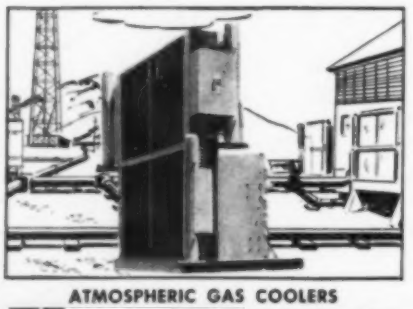

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booklet describes pulp washers, evaporators, mud filters, spray driers, etc., produced by this company for use in pulp mills.

133. Water Soluble Resin. Reichhold Chemicals, Inc., Detroit, Mich.—23-page booklet describes the properties and uses of Beckamine resins in the processing of textiles, paper and plywood.

134. Welding Electrodes. Wilson Welder & Metals Co., New York, N. Y.— 20-page catalog contains a general description of the electrodes produced by this company. An electrode selector chart is included.

135. Mechanical Flow Meters. Hagan Corp., Pittsburgh, Pa.—12-page Booklet 2M48 describes the low-pressure and high-pressure ring balance flow meters produced by this company.

136. Metering Pumps. Milton Roy Co., Philadelphia, Pa.—4-page Bulletin No. 484 describes metering pumps which will handle small volumes of liquids up to 20,000 psi., or volumes up to 2,760 gph. at low pressures.

137. Packaging. Signode Steel Strapping Co., Chicago, Ill.—24-page booklet describes methods of packaging using steel strap reinforcements. Strapping equipment produced by this company is described.

138. Pumps. Warren Steam Pump Co., Warren, Mass.—6-page Bulletin No. 245 describes pumps produced by this company for pumping erosive and corrosive liquids, together with dimensions of the standard units produced.

139. Speed Control. Electric Machinery Mfg. Co., Minneapolis, Minn.—20-page booklet describes speed control of boiler draft fans by use of the Regutron magnetic drive produced by this company. Principles of operation and installation are included.

140. Mixers. Mixers, Inc., Philadelphia, Pa.—4-page pocket sized folders describing the different types of mixers available from this company. Each of the models is illustrated.

141. Process Equipment. Farrar & Trefts, Inc., Buffalo, N. Y.—Four leaflets describing the types of fabricated process equipment made by this company. Includes information on pressure vessels of various kinds, bubble towers, condensers, heat exchangers, boilers, and other similar equipment.

142. Flexible Metal Hose. Titeflex, Inc., Newark, N. J.—24-page booklet No. 113 describes and illustrates all-metal flexible tubing. Contains information on the design and construction, specifications, and typical applications.

143. Diesel Electric Locomotives. General Electric Co., Schenectady, N. Y.—Bulletin GEA 4909 contains eight pages describing the use of diesel electric locomotives in various process industries.

144. Flocculating Equipment. Chain Belt Co., Milwaukee, Wis.—12-page bulletin No. 48-39 illustrates and describes the Rex flocculation equipment for the pretreatment of water in chemical mixing. Features of construction are illustrated and explained. Data are given for a typical installation together with diagrams.

145. Pump Controls. Black, Sivalls and Bryson, Inc., Kansas City, Mo.—Four page reprint describing the remote control of pumping stations from a centralized control panel.

146. Chemicals. Givandan Delawan, Inc., New York, N. Y.—24-page catalog listing and describing a large group of flavoring materials and extracts for various uses. Includes prices, recommended concentrations and other information.

FOR MORE INFORMATION

See Reader Service

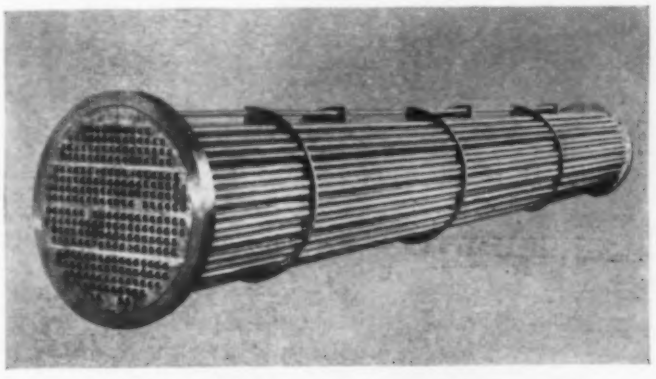
Coupon on pages 157-158

Heavier Gauges for Longer Tube Life

Engineers in petroleum refineries, petro-chemical plants and in the chemical and processing industries are showing a definite trend toward the use of heavier gauges and more corrosion-resistant tube alloys on the basis that the highest quality is most economical in the long run.

Many engineers have found, as a result of keeping careful records, that heavier gauges are the best economy from the standpoint of long service life. In some cases where .049″ (18 BWG) tubing was used, .065″ (16 BWG) is now standard. In the petroleum and chemical industries such gauges as .065″ to .083″ (14 BWG) or heavier are now frequently used.

Advantage of Heavier Gauges in Combating Corrosion—Where corrosion is proceeding at a uniform rate or is slowing down, greater wall thickness results in longer tubing life and fewer service interruptions. For example, assuming a simple case of



Tube bundle of typical heat exchanger. Courtesy The Griscom-Russell Company.

uniform corrosion where the metal is attacked at .004″ per year, an .049″ wall would be reduced to .025″ within six years. Experience has shown, in some instances, that when wall thickness reaches approximately .025″, the useful life of condenser or heat exchanger tubing has practically ended. This is due to weakening of the tube, especially in the joint at the tube sheet. Any attempt to tighten the weakened tube may result in failure of the thin wall. Furthermore, in many cases, plug-type dezincification or corrosion pits form in conjunction with the uniform corrosion and penetrate deeply into the remaining .025″ of metal. Obviously, on the same basis, tubing with a wall thickness of .065″ (16 BWG) would be more satisfactory and would last about ten years, as against six years for .049″ tubing.

Where corrosion ceases or slows up after proceeding to a certain depth, heavier walled tubing would provide the extra margin of metal, which would make the difference between early failure and long service.

Heavier walled tubing frequently makes for more satisfactory installation and for more successful flaring operations. With the proper tools no difference should be noticeable in the time required for rolling or packing the tubes, but tighter, more dependable joints should result. Heavier walled tubing is easier to thread through the tube supports and is noticeably less subject to distortion due to improper handling or long storage.

Because of the greater resistance of heavier walled tubing to distortion, relatively high stresses are not so readily set up. This means that under conditions of rough handling there is less chance of setting up stresses, which could ultimately lead to season cracking in some corrosive environments involving ammonia. Of course, increased wall thickness in itself does not guarantee immunity to season cracking.

What Gauge is Best? The answer to this question depends upon many factors. For example, research indicates that under certain conditions the corrosion rate of some alloys accelerates as the metal is attacked. In such instances, even though a heavier wall will outlast a thinner wall, the economic advantage is not significant. In other words, the heavier wall will not last enough longer to make the added expense worth while. However, where the corrosion rate remains constant or slows up with time, the economic advantage of greater wall thickness can readily be proved.

Of course, wall thickness must not be increased to the point where excessive reduction of inside diameter leads to increased water velocity, which in turn increases the possibility of impingement corrosion.

Bridgeport's Laboratory will be glad to help engineers by discussing their corrosion problems and by examining tube samples. Write Laboratory for instructions regarding the preparation and marking of tube samples. Contact the nearest Bridgeport office for service, and write for 120-page Condenser Tube Manual, covering available alloys, corrosion data, methods of installing, specifications, and suggestions for increasing tube life.

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CHEMICAL ECONOMICS

Richard F. Warren, ASSISTANT EDITOR

Last Quarter Activities Indicate Good Production Rate for the Year

AT THE beginning of the last quarter the chemical process industries were continuing to operate at high levels. The growing output of expanded chemical plants is making a big dent in backlog of many items that have been in short supply. The alkali supply situation has eased to the point where resale market price for caustic soda has dropped from a peak of more than 22c. per lb. to about 5c. per lb. Other sections of the chemical industry are also increasing output to meet the demand. An exception to this trend is the coal-tar industry. Here, need for chemicals such as cresylic acid and naphthalene has kept the supply below demand.

Fertilizer Slump

This summer saw a slump in the fertilizer industry as fertilizer tag sales in August dropped to a new low for the year. However, sales for the first eight months were 10 percent above the same period in 1947, and 68 percent above the January-August 1935-39 average. This was generally expected as industry spokesmen had predicted a return to seasonal fluctuations.

Some chemical colors that went through a seasonal slump in July were zinc yellow, as well as chrome yellow and orange. However, chrome green production rose above June levels as it ran counter to the trend.

Activities in the organic chemical industry also reflected the trend as production of large tonnage items such as benzene, naphthalene, formaldehyde, and phenol dropped off in July. However, some of this drop may be attributed to labor troubles.

Petroleum industry ignored the seasonal influences that hit other industries and continued to push consumption of chemicals higher.

Steel, a sizable consumer of chemicals, headed for new production peaks in October and November as steel men worked hard to take advantage of favorable conditions and reach maximum levels of output.

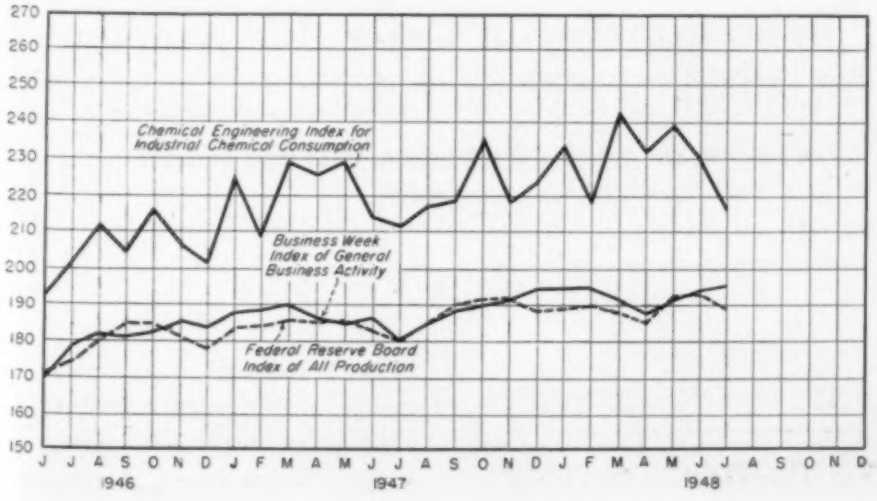
Increased urea capacity is easing the critical shortage of this basic chemical. The increase in output has been noticeable as Du Pont shipments grow. There is still a very large demand for the material in the plywood, baking enamels, plastics, textile and paper industries. Many experts feel that even the expanded capacity will fail to completely satisfy the pent-up demand. The largest consumer of urea resins is plastics, but other uses could grow considerably if the materials were available.

Chemicals consumed in glass making dropped sharply in July and rose again as plate glass output, which has been running at high levels dipped and then rose to 24.5 million square feet in August.

***Chemical Engineering* Index**
Industrial Consumption of Chemicals

1935 = 100

	June	July
Fertilizers	49.70	44.50
Pulp and paper	24.59	22.60
Petroleum refining	22.10	23.08
Glass	19.94	16.51
Paint and varnish	28.35	24.71
Iron and steel	13.35	13.01
Rayon	26.70	27.50
Textiles	11.10	9.62
Coal products	10.32	10.49
Leather	4.30	3.90
Explosives	8.34	8.20
Rubber	5.63	5.01
Plastics	7.45	7.15
INDEX	231.87	216.28



Textiles

The textile industry is consuming less chemicals this year than it did in 1947. The drop is due to the smaller cotton and wool crops. In the 1947-48 crop year, cotton consumption was down about 7 percent from the preceding year. However, the government predicts that the 1948-49 year will be about 28 percent above the recently completed crop. Wool's consumption of chemicals this year will be 6 percent below the 1947 figure, according to government reports. Rayon segment of the textile industry is doing well, consumption for the first eight months was 18 percent above 1947 rate.

Labor troubles have continued to cut into output of heavy chemicals, but the growing capacities have offset the effects of several strikes. As the labor picture improves in the winter months, the production trend will more accurately reflect the new operating potential of the industry.

Correction:

In the August issue of *Chemical Engineering* on page 300 it was stated that Virginia-Carolina Chemical had stopped making phosphorus in 1947. This is an error, according to the company. Company spokesmen state it has increased its output recently.

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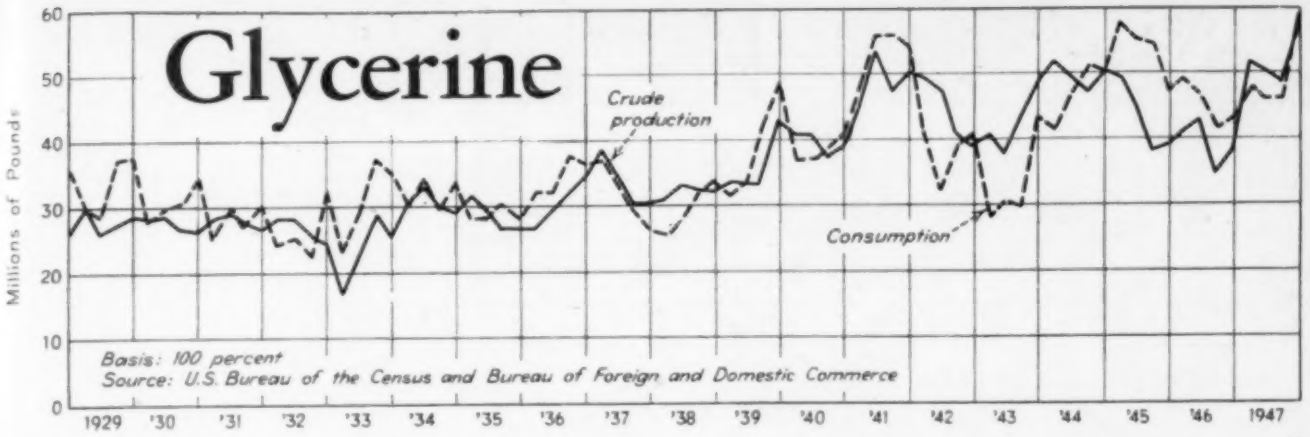


GLYCERINE production got a shot in the arm last month when Shell's new synthetic glycerine plant went on stream. This Houston unit uses a new process and (when operating kinks are ironed out) the plant will have a capacity of about 36 million pounds. This is 20 percent of the total prewar production.

Shell's new process for making glycerine uses proplyene as a raw material. This is converted to allyl chloride or alcohol which is in turn reacted with chlorine, water, and caustic soda to give a dilute crude glycerine solution. This is desalted and purified twice. The resulting product is over 99 percent glycerine.

Two firms have developed a process involving fermentation and during the war a pilot plant was built. However, this method is not used to produce glycerine on a commercial scale.

Every soap and fatty acid plant is theoretically a crude glycerine producer. However, the bulk of byproduct glycerine refining is done by firms such as Procter and Gamble, Colgate-Palmolive-Peet, Lever Brothers, Armour and Co., Swift, Harshaw Chemical, Reichhold Chemical, Pacific Soap Co., and E. F. Drew. These firms have refineries scattered throughout the country. Actual locations are shown in the accompanying table. These refineries have still capacities of about 250 million pounds per year. But this rate will be difficult to reach for long periods as production is closely tied to soap production in many units.

From variations of the modern saponification processes come "soap lye crude" and "saponification crude." Soap lye (80 percent glycerine) is produced by combining the fat with caustic. This releases the glycerine and produces soap. It is the most important commercial process. There are two major variations in the production of fatty acids and glycerine. They are: (1) low-pressure hydrolysis with a catalyst or (2) high-pressure hydrolysis in a digester—with or without a catalyst. The last two processes produce 88 percent saponification grade crude.

Refined glycerine is sold in four grades. They are: (1) USP—a water-white C.P. glycerine suitable for use in foods, pharmaceuticals and cosmetics. It has a specific gravity of 1.249 at 25 deg. C. (2) High gravity—pale yellow, for industrial uses. It has a specific gravity of 1.262 at 15.5 deg. C. (3) Dynamite—yellow, for explosives manufacture. It also has a specific gravity of 1.262 at 15.5 deg. C. (4) Yellow distilled—yellow, for industrial uses. It has a specific gravity of 1.259 at 15.5 deg. C.

The close tie-in of soap and glycerine has always created a fluctuating market price for glycerine. One of the beneficial results of Shell's new production will be the tendency to stabilize the price structure. However, since Shell's output will only be 15 percent of domestic production the extent of this stabilization is open to discussion according to spokesmen in the industry. Any effect in this direction is certainly not going to be felt in the immediate future.

A large part of Houston output is under long term contract to several chemical companies. These contracts were made before construction started. This should make larger quantities of byproduct glycerine available for expansion of other uses. Shell states that their product is non-toxic and suitable for any use. Most of its customers will steer it into industrial uses where a uniform price makes it especially attractive.

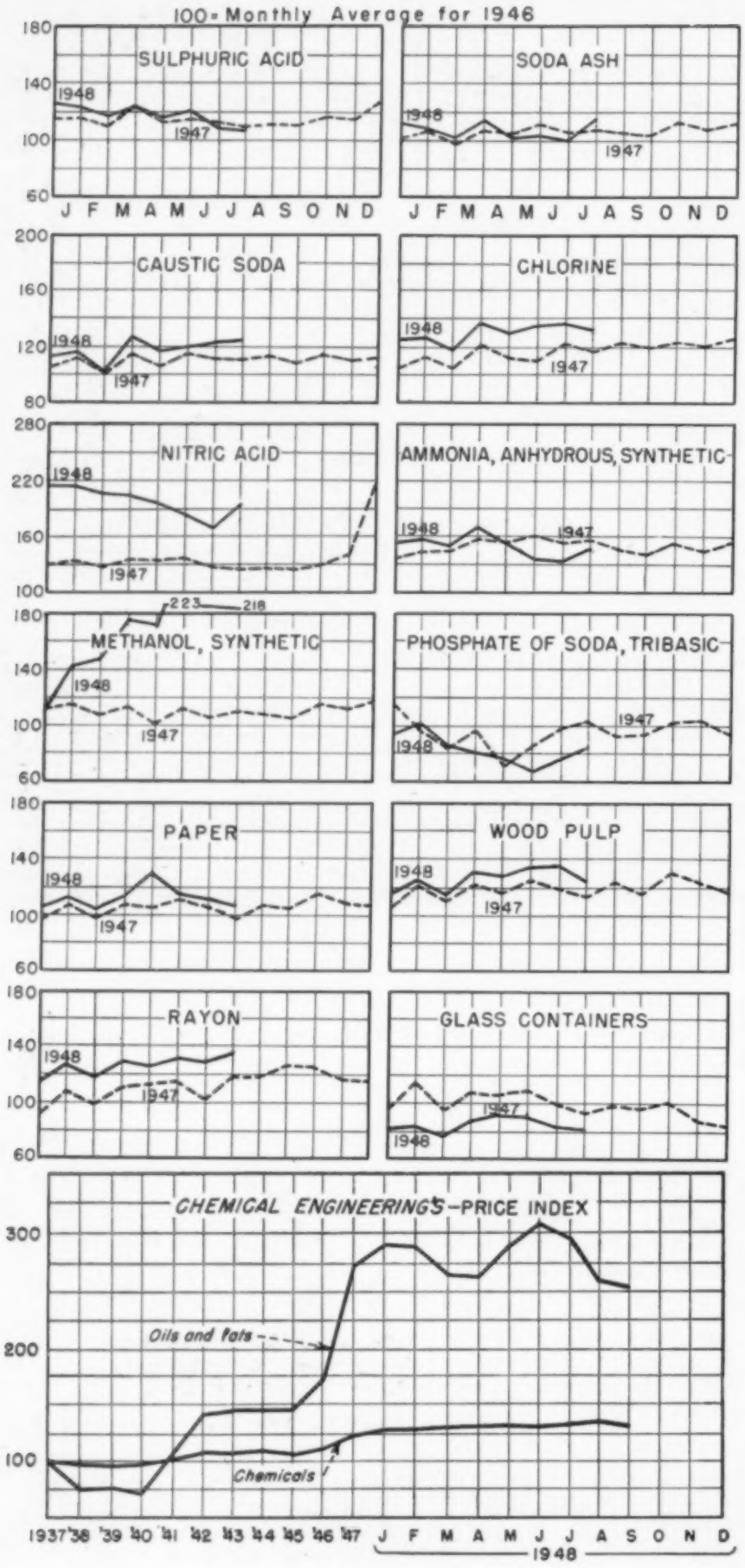
Production of crude glycerine in 1929 was 112 million pounds. Last year it was 207 million pounds. However, domestic production will not reach that level this year, even with two months help from Shell at Houston. Imports in past years have been important source of supply. In 1937, we imported 21 million pounds. Last year imports were only 3 million pounds. However, this year in the first five months imports reached the rate of 7 million pounds per year.

End uses of glycerine are numerous. Glycerine Producers Association lists 1,583 ways to use it, but the big uses are synthetic resins and ester gums (which today consume over 20 percent), tobacco, explosives, cellulose films and meat casings. The last three are listed in relative order of importance and each consumes about 12-15 percent of the total. Among other uses in order of importance are dentifrices and toilet articles, drugs and pharmaceuticals, gaskets and cork products, printers' supplies, margarine and other edibles, adhesives, textiles, beverages and candy, paper, rubber and cleaning materials.

Who Refines it . . .

Company	Plant
Procter & Gamble Co.	Long Beach, Calif. Staten Island, N. Y Dallas, Tex. Baltimore, Md. Quincy, Mass. St. Louis, Mo. Chicago, Ill. Cincinnati, Ohio
Colgate-Palmolive-Peet Co.	Berkley, Calif. Jersey City, N. J. Brooklyn, N. Y. Jeffersonville, Ind. Kansas City, Kan.
Lever Brothers Co.	St. Louis, Mo. Hammond, Ind. Baltimore, Md. Cambridge, Mass.
Shell Chemical Corp.	Houston, Tex.
Armour and Co.	Babbitt, N. J. Chicago, Ill.
Swift and Co.	Chicago, Ill.
Harshaw Chemical Co.	Philadelphia, Pa. Cleveland, Ohio
Reichhold Chemicals Inc.	Detroit, Mich.
Pacific Soap Co.	San Diego, Calif.
E. F. Drew Co.	Boonton, N. J.
Beach Soap Co.	Lawrence, Mass

PRODUCTION, CONSUMPTION AND PRICE TRENDS



PRODUCTION of both organic and inorganic chemicals reflected the seasonal fluctuation that reappeared in the postwar business picture this summer, but preliminary data point to a sizable recovery in the remaining months of 1948. New capacities for many organic chemicals indicate more production records this year. Socony-Vacuum is reported to have placed a large benzyl nitrile unit in operation recently. Shell's Houston petrochemical expansion soon will be completed. Standard of Indiana has signed a new contract with Carbide at Whiting which considerably increases Carbide's propylene supply. These events point the way to a boom in organics next year. Wood pulp capacities are going to grow in the next few years. More pulp will be available for rayon output in the 1950's when the recently formed Ketchikan Pulp and Paper Co. gets its proposed 300-ton-per-day pulp unit in operation at its new Alaskan site. Construction starts next year. Celanese has a similar project for a high alpha wood pulp output under way in British Columbia. It will have an initial capacity of about 200 tons per day. These projects indicate the optimistic outlook of the rayon producers, and show that we are still in a period in which producers are making substantial efforts to insure their supply of raw materials.

Price Trends

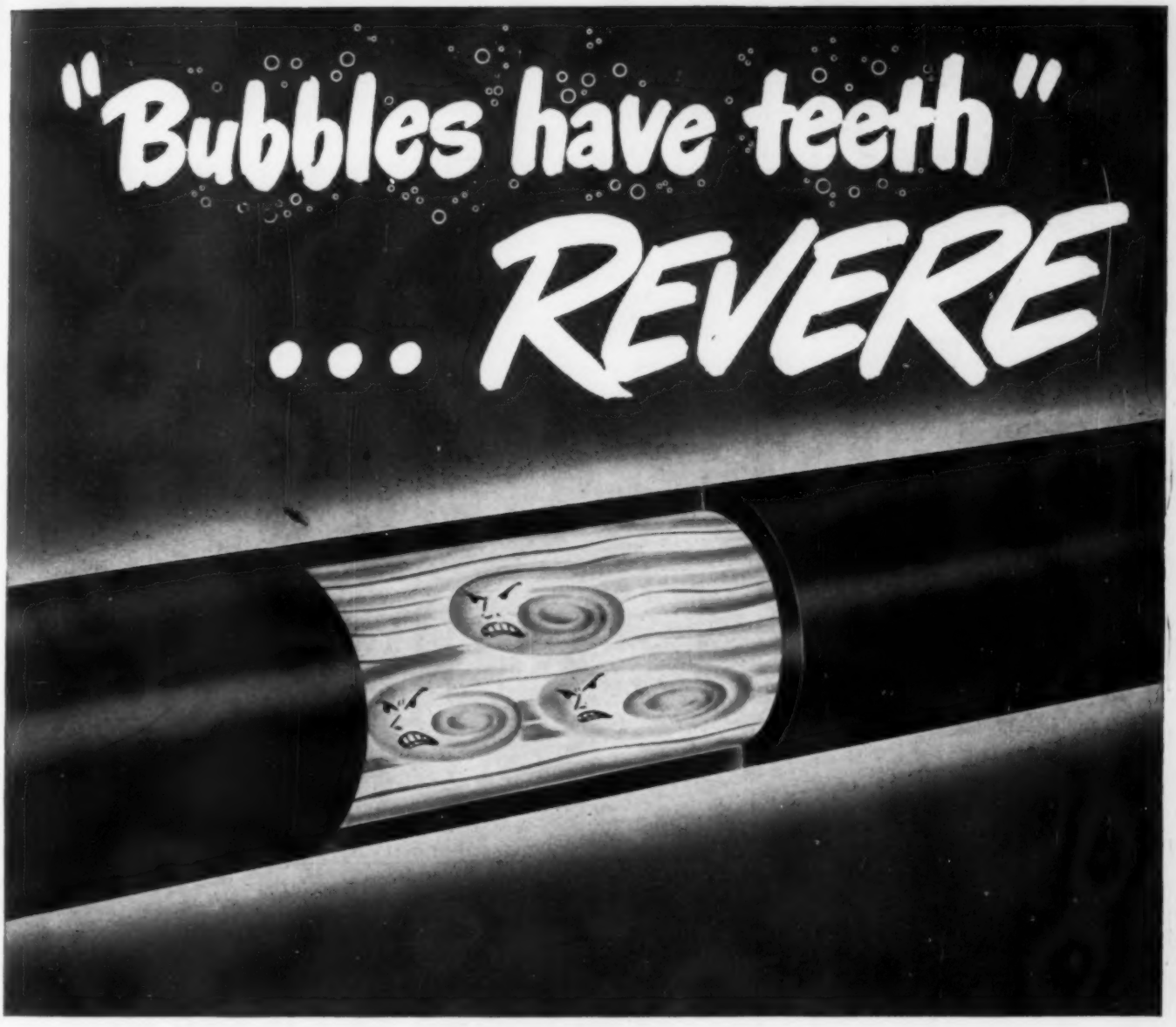
Price changes last month were mixed. Oils and fats dropped off while the general chemical trend was up. Prices of sulphuric, acetic, and oxalic acids rose on October 1. Other increases were registered in the case of ethylene glycols, acrylonitrile, and dibasic ammonium phosphate. Among the chemicals that dropped were creosote and crude coal tar. *Chemical Engineering*'s price index reflected the increasing cost of chemical production as the Chemicals index rose slightly in October. However, the Fats and Oils index fell to a new low for the year.

Chemical Engineering

WEIGHTED INDEXES OF PRICES

Base = 100 for 1937

	Chemicals	Oils & Fats
As of October 1..	132.80	249.27
Last Month	132.22	251.67
October 1947	124.94	251.70
October, 1946	111.82	161.52



SOME years ago Revere said that "Bubbles have teeth." It is still true. Air bubbles in a condenser can eat away at the tubes quite rapidly, and become a cause of failure with consequent re-tubing. Air-entrainment, as it is called, acts in several ways, all destructive to tubes. Air contains oxygen, which directly attacks most metals, forming oxides. Carbon dioxide in solution dissolves these oxides. That is not all. Air bubbles add to the erosion effect of turbulent flow. The higher the velocity, the worse the effect, and the more swift and serious is the combination of erosion and corrosion at points of greatest disturbance. Every effort should be made therefore to keep air from being carried into the cooling water. If you are troubled by frequent re-tubing of your condenser, get in touch with Revere, but first save a few samples from failed tubes for examination by our laboratories to determine the cause of failure. Many users of condenser tubes have found our collaboration exceedingly valuable, and we are always glad to cooperate in an effort to extend tube life.

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United States Production of Certain Organic Chemicals

June 1948, June 1947, and Six-Month Totals for 1948 and 1947

	June 1948	June 1947	Total, Six Months 1948	1947
Acetanilid	142,166	785,106	1,875,241	4,209,293
Acetic acid:				
Synthetic	35,739,677	29,843,273	199,046,761	183,162,132
Recovered	131,203,932	93,770,807	722,687,744	702,631,489
Natural	2,301,028	1,885,238	12,746,285	12,258,694
Acetic anhydride	57,099,826	41,433,264	366,872,129	297,793,614
Acetone	41,097,468	34,669,369	251,757,410	184,838,645
Acetylsalicylic acid	648,656	1,155,444	4,296,722	6,031,569
Aniline	7,166,226	9,692,065	50,376,089	55,023,239
5-Ethyl-5-phenylbarbituric acid and salts, phenobarbital	15,553	39,002	207,137	220,328
Benzene:				
Motor grade:				
Coke-oven operators	757,513	1,339,105	4,196,405	9,836,224
All other grades:				
Tar distillers and petroleum	1,030,773	1,481,742	15,580,301	12,067,082
Coke-oven operators	11,864,960	11,332,667	72,690,891	72,651,800
Butyl alcohol, primary, normal	8,337,429	11,012,565	61,129,287	72,188,598
Carbon bisulphide	32,791,873	29,328,736	205,061,164	272,797,726
Carbon tetrachloride	15,971,606	16,935,853	105,355,877	99,633,160
Chlorobenzene, mono	23,663,814	30,773,625	156,318,139	158,429,918
Creosote oil:				
Tar distillers	7,666,515	9,559,375	53,128,113	64,071,798
Coke-oven operators	2,987,068	3,219,217	.....	19,748,107
Cresols, meta-para	735,469	640,183	4,399,202	2,930,510
Cresols, ortho-meta-para	812,757	730,111	4,327,990	4,786,527
Cresylic acid, refined	2,742,977	1,908,809	14,202,642	13,010,585
Dibutyl phthalate	615,593	2,038,463	8,019,529	10,730,286
Dichlorodiphenyltrichloroethane (DDT)	355,262	5,320,221	9,367,776	26,998,349
Ethyl acetate, 85 percent	5,762,529	6,826,497	33,795,705	44,069,618
Ethylene glycol	30,741,787	18,183,883	165,900,046	99,497,650
Ethyl ethers	2,979,121	3,447,205	17,134,427	22,055,740
Formaldehyde, 37 percent	50,541,825	44,374,646	324,691,091	269,063,155
Hexachlorocyclohexane	1,567,942	566,056	9,238,599	1,887,086
Methanol, natural	1,335,078	1,177,504	8,221,056	8,184,889
Methanol, synthetic	89,201,650	43,497,136	442,392,674	268,278,154
Naphthalene:				
Tar distillers, less than 79°C	16,997,455	18,097,227	101,458,351	116,986,282
Tar distillers, over 79°C	8,086,891	9,329,964	52,190,785	51,550,525
Coke-oven operators, less than 79°C	8,421,981	9,020,335	49,280,309	46,414,591
Penicillin and salts	8,080,588	2,545,670	45,023,288	16,873,583
Phenol	22,936,803	23,986,649	146,149,545	123,141,466
Phthalic anhydride	11,606,215	11,763,884	76,872,176	66,119,350
Styrene	31,005,019	23,281,493	186,304,390	162,426,654
Toluene, coke-oven	2,460,296	2,090,799	13,964,130	13,007,013
Toluene, all other	3,932,820	3,591,885	24,944,023	13,791,204
Xylene, crude	7,036,011	2,611,099	32,161,562	23,802,631

All data in pounds except benzene (gal.) creosote oil (gal.) toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics, collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential.

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F—13A

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To be well-informed about the latest developments in *your* business, *your* industry... and to stay well-informed... *read all the ads too.*

CHEMICAL ENGINEERING

WITH CHEMICAL & METALLURGICAL ENGINEERING

A McGraw-Hill Publication

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SHEPARD
Newton's Law Still Holds Good
Gravitation doesn't appear as a plant expense but it's a big factor in keeping costs up. Not even a feather will raise itself into working position, move sideways or deposit itself where needed. Human or steel muscles are needed to lift and move raw materials, semi-finished goods and finished products.
Where heavy loads are concerned, plant engineers don't depend on human muscles, but think in terms of a Shepard Niles overhead traveling crane. With a multitude of sizes and types available, there's bound to be one to fit your own needs — and a trained, experienced engineer of America's leading builder of overhead traveling cranes will help you select the one best fitted for your needs.
No matter what size or style Shepard Niles overhead traveling crane is selected to do your job, you can depend on sound design, rugged and precise construction, reserve capacity and economical, trouble-free operation year after year.
★ Shepard Niles engineers may feel an electric hoist is better fitted for your needs than an overhead traveling crane. Their recommendations are unbiased because Shepard Niles makes both. Only the type crane or hoist best suited for your job will be recommended.
Shepard-Niles
CRANE & HOIST CORPORATION
382 SCHUYLER AVE. • MONTOUR FALLS, N. Y.

NEW CONSTRUCTION

	Current Projects		Cumulative 1948	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$246,000	$125,000	$3,577,000
Middle Atlantic	$143,000	765,000	7,504,000	53,018,000
South	.....	725,000	78,353,000	74,741,000
Middle West	.....	800,000	12,950,000	53,503,000
West of Mississippi	12,900,000	8,203,000	167,038,000	98,008,000
Far West	268,000	629,000	13,918,000	32,246,000
Canada	.....	1,928,000	89,750,000	37,874,000
Total	$13,311,000	$13,296,000	$369,638,000	$352,967,000

Proposed Work

Ark., El Dorado—Lion Oil Co., El Dorado, Ark., plans to construct a plant for the manufacture of protective coatings. Estimated cost $250,000.

Calif., Berkeley—California Ink Co., 711 Camelliia St., plans to construct a 1 story rotogravure ink plant. E. O. Roseberg, 1950 Addison St., Archt. Estimated cost $68,000.

Idaho, Huetter—Ohio Match Co., Western Div., Coeur d'Alene, plans to construct a match plant here. Estimated cost $200,000.

Mont., Helena—Permente Cement Co., Latham Sq. Bldg., Oakland, Calif., plans to construct a cement manufacturing plant. Estimated cost $6,000,000.

N. J., Winslow Junction—Alliance Clay Products Co., Alliance, O., plans alterations and additions to its plant here. Estimated cost $75,000.

Pa., Easton—General Aniline & Film Corp., 457 Lincoln St., plans to construct high pressure laboratory buildings. Estimated cost will exceed $68,000.

Tex., Borger—Rock Creek Carbon Plant, Borger, plans to reconstruct its machine shop and three warehouses. Estimated cost $150,000.

Tex., Carthage—United Gas Corp., United Gas Bldg., Houston, plans to double the capacity of its gas plant. Estimated cost $2,750,000.

Tex., San Antonio—D. W. Haering & Co., Inc., 205 West Wacker Blvd., Chicago, Ill., and Second Natl. Bank Bldg., Houston, has acquired a 17 acre site on Harding Blvd., in Harlandale, and plans to construct a chemical plant. Ralph H. Cameron, Transit Tower, Archt. Estimated cost $3,000,000.

Tex., Waskom—LaGloria Corp., Driscoll Bldg., Corpus Christi, plans to construct a natural gasoline plant here. Estimated cost $750,000.

Contracts Awarded

Calif., Sacramento—Zellerbach Paper Co., 1213 Front St., has awarded the contract for a plant and office building to Campbell Construction Co., 800 R St., at $559,000.

Calif., Newark—Morton Salt Co., Newark, has awarded the contract for a 1 story addition to its warehouse to Indenco Engineers, 656 31st St., Oakland. Estimated cost $70,000.

Fla., Vero Beach—Armour Fertilizer Co., Hurt Bldg., Atlanta, Ga., will construct a fertilizer plant and office building here. Work will be done by owners. Estimated cost $75,000.

Ind., Indianapolis—Glidden Co., 1160 West 18th St., has awarded the contract for an extraction building and warehouse at its soy bean mill, to Chris Jensen Co., 1385 Shelby Ave., St. Paul, Minn. Estimated cost $800,000.

Ky., Owensboro—Fleischman Distilling Co., Owensboro, has awarded the contract for a 350x400 ft. plant to George H. Rommel Co., 958 Logan St., Louisville. Estimated cost $650,000.

Mass., Everett—Standard Oil Co. of New Jersey, 378 Stuart St., Boston, has awarded the contract for a warehouse addition and oil terminal to Frankini Construction Co., 26 Mystic Ave., Medford. Estimated cost $172,000.

Mo., St. Louis—General Paper Stock Co., 1100 North 7th St., has awarded the contract for a 1 story, 60x127 ft. paper storage plant to Fruin-Colnon Contracting Co., 1706 Olive St. Estimated cost $100,000.

Mo., St. Louis—Merck & Co., Inc., 4528 South Bway., has awarded the contract for warehouse, two small storage buildings and sales and distribution center at Maury and Oleathe Aves., to Gamble Construction Co., 804 Pine St.

Pa., Lansdale—American Franklin Olean Tile Co., Kenilworth Ave., has awarded the contract for a 1 story plant addition to Austin Co., 19 Rector St., New York, N. Y. Estimated cost $75,000.

Pa., Norristown—Norristown Magnesia & Asbestos Co., East Washington St., has awarded the contract for factory alterations to Frank R. Heavner, Montgomery Trust Arcade. Estimated cost $90,000.

Pa., Valley Forge—Ehret Magnesia Manufacturing Co., 1315 West Cumberland St., Philadelphia, will construct an addition to its plant. Work will be done by separate contracts. Estimated cost $600,000.

R. I., Wood River Junction—Sun Chemical Co., Warwick Div., has awarded the contract for a chemical plant to Rowley Construction Co., 260 Central Ave., Pawtucket. Estimated cost $74,000.

Okla., Drumright—Tidewater Associated Oil Co., Thompson Bldg., Tulsa, has awarded the contract for the design and construction of a Houdry thermofor catalytic cracking unit refinery to Process Engineers, Inc., 5635 Daniels St., Dallas. Estimated cost $600,000.

Tex., Baytown—Humble Oil & Refining Co., Baytown, has awarded the contract for a 55,000 bbl. daily capacity pipe still to Foster-Wheeler Corp., Shell Bldg., Houston. Estimated cost $2,975,000.

Tex., Cisco—Cisco Hydrocarbons Co., c/o E. Armstrong, has awarded the contract for a natural gasoline, propane and butane plant to Fish Engineering Co., M & M Bldg., Houston. Estimated cost $1,500,000.

Tex., Houston—St. Joe Paper Co., Clinton Docks, has awarded the contract for a paper box manufacturing plant to Austin Co., M & M Bldg., Houston. Estimated cost $960,000.

Tex., Ozona—Continental Oil Co. & Assoc., Ponca City, has awarded the conttract for the design and construction of a refinery to have a daily capacity of 60,000 gal. hydrocarbons and 10,000,000 ft. gas daily capacity, to Refinery Maintenance Co., Compton, Calif. Estimated cost $2,000,000.

B. C., Vancouver—Canadian Industries, Ltd., Box 10, Montreal, Que., has awarded the contract for a 1 story, 152x202 ft. plant to Dominion Construction Co., Ltd., 150 West First Ave. Estimated cost $300,000.

Ont., Hamilton—Canadian Industries, Ltd., Box 10, Montreal, Que., has awarded the contract for a sulphuric acid plant and pesticides plant to Piggott Construction Co., Ltd., Piggott Bldg. Estimated cost $1,039,000 and $441,000 respectively. Company will build hydrochloric plant with own forces. Estimated cost $72,000.

Ont., Nobel—Canadian Industries, Ltd., Box 10, Montreal, Que., will construct a nitric acid plant with own forces. Estimated cost $548,000.

Ont., Sioux Lookout—Canada Creosoting Co., Ltd., Sun Life Bldg., Montreal, will construct portion of its plant recently damaged by fire. Work will be done with own forces. Estimated cost $75,000.

Ont., Toronto—Sharpe & Dohme (Canada) Ltd., has awarded the contract for a laboratory building to Dickie Construction Co., Ltd., 17 Yorkville St. Estimated cost $125,000.

Que., Brownsburg—Canadian Industries, Ltd., Box 10, Montreal, Que., has awarded the contract for a plastics plant addition to J. L. E. Price & Co., Ltd., 680 Sherbrooke St., W., Montreal. Estimated cost $208,000.

Que., Shawinigan Falls—Canadian Industries, Ltd., Box 10, Montreal, has awarded the contract for the construction of a cellulose plant to Fraser-Brace Engineering Co., Ltd., 360 St. James St., Montreal. Estimated cost $600,000.